

# Creativity

ITS RECOGNITION AND DEVELOPMENT

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**Creativity**  
**Its Recognition and Development**





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## Preface

The education we impart today to our children merely centers around the learning which at the best help them in the acquisition of certain information, desirable habit patterns, and skills but what is more important is to prepare them to meet their individual needs on the one hand and contribute their mite to the good of the society and also be a source of satisfaction to themselves on the other. This necessitates the shifting of emphasis from mere routine-type of teaching and learning to creative problem-solving and learning.

In discussing creativity one should not go to the absurd extent of claiming that each and every child can be turned as a Newton, or an Einstein, or Shakespeare, but what every teacher can confidently claim is that potential for creativity exists in every one and only awaits the proper environment in which each and every one can sprout and be nurtured to the fullest development.

This purpose is best achieved when besides conducive atmosphere in the homes, there is an effective environment in the schools and the classrooms wherein the teachers as well as the students are willing to play the new roles, that the teachers are prepared to shed their traditionally authoritarian roles and structure the educative process in the way that the students are stimulated to explore problems for themselves and seek their solutions; and that the students are prepared to leave the stereotyped thinking and learning and strive for self-actualization and initiate the learning on their own.

Those who are interested in the field of creativity will find this book useful in more than one way. The author has attempted to collect the material which is scattered through a great variety of sources, including unpublished material to fulfill the needs of the student community as well as researchers to a great extent. The next purpose of this book is to stimulate the thinking of prospective researchers in the field in regard to the growing realisation of the importance of creative talent, and the discovery of new ways and techniques to foster creativity among children.

In the first chapter, the reader gets himself acquainted with the growing importance of the creativity. The second chapter provides theoretical perspectives. Different personality, learning, and cognitive theories constitute the third chapter.

The nature of relationship between intelligence and creativity has been discussed thoroughly in the fourth chapter including the Guilford's Model of intellect and creativity. The fifth chapter deals with the issues concerning the relationship between creativity and achievement.

In the sixth chapter, the author has attempted to trace the personality characteristics associated with a creative child and a creative adult.

Education is treated at full length in the seventh chapter wherein the creative teaching, creative teacher, and creativity in different areas have been discussed. The problems concerning the issue of measurement of creative potential and different testing techniques used in the identification of a creative person have been presented in the 8th chapter.

The main focus of the book "Development of creative talent" has been discussed in the 9th chapter. Different techniques for the development of creative talent have been presented in detail in this chapter. A comprehensive list of references utilized and assembled in the preparation of this book is presented at the end of this book.

I am really thankful to all the authors whose material I have consulted and referred to in this book as they provided

me an inspiration and an opportunity to give elaboration to my own views. I am thankful to the publisher for timely publication of this book. I also owe my thanks to all those who rendered any sort of help in the preparation of this book.

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# 1

## Introduction

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No nation whether big or small can afford to overlook the importance of creativity in this age of competition. Who survives this competition largely depends upon its creative minds. The creative acts affect enormously not only scientific and technological progress, but society in general. The nations who learn best how to identify, encourage, and develop the creative potential in their people may find themselves in very advantageous position. On the contrary, the nations that are still underdeveloped are rather differently motivated towards the identification and development of this rare talent.

Although creativity has been a topic of some interest throughout man's history, but it is only very recently when efforts were made to study it scientifically. Prior to 1950, there were only trickle of research articles on creativity. The Russian threat in technological advancement was probably the immediate reason for American scientists to sensitize the need of creativity in technological competition. The credit goes to Guilford who opened the present era of research in creativity with his 1950 presidential address to the American psychological association in which he alerted the psychologists to the need for work in creativity. It is he who in his 'Structure of Intellect Model' has effectively redefined intelligence so as to include creative behaviours. With a consistent and cumulative effort he succeeded in evolving a battery of tests which operationally specify dimensions of intelligence that go far beyond that traditional tests of intelligence have included. Using factor analysis, he has isolated 120 separate, measurable abilities. Present intelligence tests hardly measure six to eight of these abilities. By 1977 Guilford was able to operationally specify 100 of the total 120 abilities. Guilford first of all focused on adults in military establishments and concluded that

concern for creativity is a basic concern in the national interest that needs to be and can be productively pursued. Having opened the field to the adults, he also opened it for the children and youth. His concepts and tests were used by educators and others in school situations and devised further tests on creativity.

What Guilford showed to be intellectually wrong in conceiving of intelligence in narrow terms; Getzels and Jackson (1962) showed it to be also educationally wrong. Benefitting from Guilford's break-through and devising tests for creativity, they attempted to seek the relationship between intelligence and creativity and revealed that it was not possible to trace the able students if alone traditional measures of intelligence would have been used, and again, the cream of the students would have also been missed. They concluded that it is not only the intelligence tests that are biased against the highly creative children, but also the teachers. Guilford, Getzels and Jackson had undoubtedly opened the new era but it remained to Torrance to unravel unfailingly the positive domain in educational practice.

Torrance (1965) developed tests of creativity that are extensively used by teachers for several levels of education in classroom settings to cultivate creativity in children through their daily teaching practices. He also developed programmes for teacher training. In regard to intelligence and creativity he has demonstrated that we miss about seventy per cent creative children when we depend solely on traditional tests of intelligence to measure ability. He, too, finds some correlation between creativity and intelligence upto 120 IQ and beyond that both are independent in their future direction.

Most psychological researchers generally agree that all persons have some creative potential, though there are wide individual differences in degree. Lowenfeld (1959) distinguished between actual creativity and potential creativity, the former being that potential which is already developed and functioning, the latter including the total creative potential (both developed and undeveloped) within an individual.

Taylor (1962) points out that many lay persons have a quite different notion from that held by psychologists when they think of creativity in the arts. They believe that most people have zero potential

to be creative, whereas a few persons have creative talent in varying degrees. The psychologists, on the other hand, are of the opinion that all persons have some degree of potential to be creative in one or more ways. It is now recognised that creativity is not limited essentially to certain fields of the arts and sciences rather it should be expected generally in human activities.

Researchers also agree that creativity occurs at all ages, in some aspects of all cultures, and to some degree in all fields of human work and endeavour though there are marked differences in the frequency, level, and type of creativity across these categories. Again, despite the notion that some fields of endeavour require more creativity, they may not necessarily do so at all times; creative bursts on the other hand may occur in fields not often thought of as creative.

People now begin to realize that creativity is in each one of us which could no longer be left to the chance occurrences of the genius; neither it could be left in the realm of the wholly mysterious and the untouchable. Men had to be able to do something about it; creativity had to be a property in many men; it had to be something identifiable, it had to be subject to the effects of efforts to gain more of it (Razik, 1967). Two things can be said with confidence. First, psychologists are convinced that all people are, to some degree, potentially creative despite their age levels, cultures and fields of human endeavour. Second, individuals, vary in their degree of creative potential for various fields of activity and in the modes of expression of their creativeness.

Various factors have been identified that go with creative performance. Among them certain personal and situational attributes have been found to be more promising predictors of creative performance than others. For instance, certain intellectual characteristics such as, originality, redefinition, flexibility, fluency, elaboration, and evaluation have come out as valid measures of creative performance. In broader terms, a few components of memory, cognition, and evaluation, convergent production, and divergent production are involved in creative work. Divergent production seems to be the most important for the production of ideas in both quantity as well as in quality as it involves originality, flexibility, sensitivity, and

ability to redefine. The fact that these intellectual aspects of creativity are relatively distinct components indicates the probability of multiple types of creative talent. There is probability also that some of these intellectual components underlie some of the motivational forces in the creative person such as drive, dedication to work, resourcefulness, striving for general principles, desire to bring order out of disorder, and desire for discovery.

The intellectual and motivational factors are linked significantly to certain personality characteristics. Several personality traits have been found to be valid indicators of creative potential, among them self-sufficiency, independence, openness, stability, tolerance to ambiguity, feminity in interests, and self-confidence rate first. Creative people in different fields may have different personal characteristics. The personal characteristics possessed by artists may not be the same as scientists do have. However, researchers generally agree that the creative individual tends to produce adaptive responses that are original in nature. About their adjustment it is said that, whereas the typical person focuses on adjusting to his environment, the creative individual tries to adjust the environment to him, to improve it in ways that he feels are urgently needed.

Environmental influences also affect the creative potential. These can either enhance or hinder development of those attributes which seem to be predictors of creative performance. These influences include factors involved in educational settings, working conditions and climate and training programmes. Home environments also may be regarded as external influences modifying creative attributes either in positive or negative directions.

Researchers are generally agreed that education can do a great deal in promoting creative performance through environmental manipulation. For Lasswell (1950), the environment serves as facilitator and as restrictor both in the innovation process and in the process of discovery and recognition of the innovation. Anderson (1961) has used the concepts of "Open" and "Closed systems" in discussing the facilitators and inhibitors of creative development in education. The open system permits originality, experimentation, initiative and invention. The closed system, on the contrary, is concerned mainly with

the acquisition of knowledge, memorization of facts, and finding already known answers to problems.

Sinnott (1959) discussed genetic variation and also creativity as response to environment. For him the changes of the mind are not dependent on genetic change rather are they the result of the enormously varied responses of a given genetic constitution to environmental differences and much of the variety of all organic life is due to environmental variety.

The environmental factors which are related to creativity are those which encourage and facilitate openness in thought and action and provide for discovery of new ideas. Mead (1959) discussed creativity in cross-cultural perspective. She has given an elaborate analysis of the relationship between the forms provided by a culture and the creativity of the individuals within the culture. Torrance (1962a) in his cross-cultural studies has shown that several cultures and sub-cultures impede the growth of creativity through subtle, consistent pressure for conformity. He has, further indicated that children experience great difficulty in maintaining creativity due to discontinuities. These discontinuities seem to be culture-made rather genetic.

Torrance (1961) argues that "perhaps the most promising area in unfolding creativity is that of experimentation with teaching procedures which will stimulate students to think independently, to test their ideas, and to communicate them to others." Parnes (1963) has pointed out that there is no research yet reported that is inconsistent with this view that creative productivity can be developed through deliberate procedures. The committee set up for the first time in 1959 to report on the role of educational experience in the development of creative scientific talent reported that at least six research projects had indicated that creative productivity can be developed by deliberate procedures (Taylor, 1959). Parnes concludes that there is a firm basis for the conviction expressed by Guilford (1952); "Like most behaviour, creative activity probably represents to some extent many learned skills". In the same vein, Maltzman and his associates (1959) at the university of California concluded a group of research studies on originality training and asserted that the results support the hypothesis that "originality is a learned form of behaviour which does not differ in principle from other

forms of operant behaviour”.

Since research has demonstrated that a considerable part of creative behaviour is learned, courses in creative problem solving have been multiplying. The courses have also been used in special programmes for groups of students in engineering, law, medicine, education, business, physics and psychology. Parnes (1959) points out that the students who took the course registered substantial gains on the tests measuring various factors included in creativity.

Various techniques of creative problem solving are used to develop the creative efficiency. These techniques facilitate solutions that are creative, i.e. solutions characterized by freshness, appropriateness, imagination, new relationships between even common place facts, or ideas, and significant transformations of the initial definition of the problem.

Two methods which seem to differ from the usual problem solving approaches but which apparently do not attempt to alter emotional dispositions are “attribute listing” and “Morphological analysis.” Attribute listing is used for improving product design. Here, creation is not just mechanically combining different ideas rather it is useful modification of an attribute, or assimilation of attributes of other objects. Morphological analysis involves combining the major attributes of the major variables of a problem into a grid so that all possible combinations can be considered. This method facilitates the imagination by enabling the individual to focus on one aspect of the situation at a time.

Brainstorming (Osborn, 1957) and Synectics (Gordon, 1961) are other approaches of creative problem solving which contain within their methodology the objective of freeing a person from the usual inhibitions that operate to block his creative process. The primary aim of the brainstorming approach is to encourage the individuals to drop their defensiveness, not to use critical judgement prematurely, and instead of competing for power and status, they compete for excellence and creativeness of their ideas. The members of the group are asked to express their ideas readily, spontaneously, and uncritically until a good quantity of ideas is available to be judged. The advocates of synectics approach believe that people who understand what psychological

processes are required can markedly-increase their own creative efficiency. In the creative process, the emotional aspects of the task are seen as more important than the rational aspects. Four psychological states that characterize the creative process are detachment involvement, deferment, speculation, and autonomy of the object. It is not mere involvement or speculating or detaching which helps in increasing creative efficiency, operational mechanisms also are used to help produce each of these mental states. Since making the familiar strange and the strange familiar are the goals of synectics approach, four mechanisms such as, personal analogy, direct analogy, symbolic analogy, and fantasy analogy are used. This method provides specific techniques for using the vast storehouse or man's vivid associations.

Inquiry training was developed by Richard Suchman (1962) to teach students a process for investigating and explaining unusual phenomena. The main aim of this approach is to develop scientific process skills in the students. Since the model is built on the assumption that all knowledge is tentative, is thought to be very useful in training students build new theories and answers to various problems.

Creative thinking, as such, a way of problemsolving suggests that every child can be trained to use his mind creatively. There is ample research evidence to show that men fundamentally prefer to learn in creative ways, through creative problemsolving activities (Torrance, 1970). Creative teaching and learning open up new exciting vistas both for the teacher and the child. Creative teaching and learning however, is fostered under certain conditions. Rogers (1954) has termed these conditions as "psychological safety" and "Freedom." Psychological safety is achieved when the individual child is accepted as of unconditional worthy; is provided a climate in which external evaluation is absent; and is understood empathetically. The psychological freedom provides the individual child a permissive climate in which he is completely free to think, to feel, to be, whatever is most inward within himself.

Progress in fostering the creativity of our children will be obtained most effectively if we understand that we must simultaneously progress in the preparation of the individual, from both an intellectual and an emotional point of view, and in the provision of a stimulating climate.

## 2

# The Nature of Creativity

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Creativity is regarded the greatest asset of mankind. It is an ability that is most vital for shaping the future of man. The interest in creativity and in its research is traced as from the second half of the present century when Americans realized that Russians were overtaking them in many areas especially in space research. The credit for opening the present era of research in creativity goes to Guilford who in his 1950 presidential address to the American Psychological Association pointed out the need for starting systematic and well planned studies on creativity especially with regard to the identification and development of creativity.

Creativity has been approached differently by different thinkers. Philosophically, creative thinking is not a peculiar type of thinking that has different non-publicly observable features from other types of thinking. For a philosopher a creative thinker is one whose thinking leads to a result which conforms to criteria of value in one domain or another. While discussing creativity, Plato made a distinction between artificial art and true art. He said, artists deal only with appearances and not with reality itself. True artists, for him are those who bring into birth some new reality. They are creative as they enlarge human consciousness. Scientifically creativeness involves an imaginative leap to a new perspective. The scientist searches for a hypothesis which is likely to fit the facts he is concerned with. Poincare has expressed creativity as the capacity to be surprised, as many scientific discoveries are made just in this way. The scientist observes a phenomenon which many others before him have been without getting puzzled. A scientist has the capacity to be surprised, anything obvious for others becomes a problem for him, his mind starts working on it and it becomes the



beginning of his discovery. What makes him a creative scientist is only partially his ability to solve the problem and the ability to getting puzzled is largely responsible for making him different from the average scientist. Social Scientist approaches creativity with respect to interpersonal relationships. For him, creativity is a social invention whose product is not an object but persons; creativity in human relationships. Such a person is regarded creative who is intelligent and possesses sharp perceptions, subtle sensitivities, respect for the individual person, boldness to explain one's point of view and to stand for one's convictions.

Psychologists and psychoanalysts have also approached the creativity but they too differ in their views. Some have equated it with mental health, some have related it to the personality development while others have restricted it to an interplay of unconscious and conscious. Sinnot (1959) equates creativity with life itself by virtue of its organising, patternforming and questing quality. It is only with the imagination which is a quality of mind, makes possible the creativeness in a man.

Murray (1948) defines creativity in terms of the product. For him, creation will refer to the occurrence of a composition which is both new and valuable. New means that the entity is marked by more than a certain degree of novelty or originality. relative to sameness or replication, and valuable means either extrinsically or intrinsically valuable as such to one or more persons or generative of valuable compositions in the future. Guilford (1960) also lays emphasis on the divergent production, however, he has conceptualized creativity in terms of mental abilities involved in creative achievement. In view of his factor analytic studies he has clearly shown the presence of divergent production in creative thinking which he defines as the generation of information from given information where the emphasis is on variety of output.

Rogers (1957) sees creativity essentially as a process. Creative process, he defines, that is is the emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people or circumstances of his life on the other. Uniqueness of the individual, he refers to man's

tendency to actualise himself, to become his potentialities. The novelty of the product is judged by the fact that the more original the product, the more far-reaching its implications, the more likely it is to be judged by contemporaries as evil. Rollo May (1959) considers creativity as process of bringing something new into birth. He says that we cannot speak of a creative person, we can only speak of a creative act. For what is occurring is always a process, a doing; specifically a process interrelating the person and his world; therefore, creativity is the encounter of the intensively conscious human being with the world.

Erich From (1959) looks at creativity from another point of view. He defines creativity as an ability to see (or to be aware) and to respond. For him, most people are not aware of and do not respond to anything. To see the other person creatively means to see him objectively, that is, without projections or distortions. It means to wake up fully to the awareness of reality, inside and outside of oneself. One can experience creativity only when he has reached a degree of inner maturity which reduces projection and distortion. For Maslow creativity is a maximum of self-actualizing. He says that creativeness is not the sole prerogative of certain professionals like theorists, artists, scientists, inventors, writers or it cannot be confined to certain conventional areas rather it is the universal heritage of every human-being that is born and which co-varies with psychological health. Maslow (1962) distinguished special talent, creativeness, and self actualising creativeness. The former is the result of his abilities in special fields while as the latter takes birth by the fusion of primary and secondary processes. Self actualizing creativeness stresses the personality rather than its achievements, considering these achievements to be epiphenomena emitted by the personality and, therefore, secondary to it. According to him, self-actualizing creativeness is emitted like radio-activity like a cheerful person who emits cheerfulness without purpose, design or even consciousness.

Stoddard (1956) stresses on the act. For him, to be creative, is to be unpredictable; it is to be decidedly suspect in the world of affairs. He says that the creative act at its highest brings about notable differences in things, thoughts, works of art, and social structures.

Anderson (1959) approaches creativity in a quite different way. In

his view, creativity is not all that can be judged by the object produced i.e. that can be seen, studied or enjoyed. For him, there is another kind of creativity to which he refers as a psychological or social invention whose product is not an object as such; this kind of creativity is not with objects but rather with the persons and their social relationships. Therefore, creativity is an optimum growth in social interaction that cannot be forced or co-erced, it can only be facilitated or restricted in each and every individual as it is found in every living cell.

Torrance (1962) defines creativity as the process of seeing problems, or gaps in information, forming ideas or hypotheses, testing and modifying these hypotheses, and communicating the results." Barpett (1958) used the term 'adventurous thinking' which he defined as "getting away from the main track, breaking out of the mould, being open to experience and permitting one thing to lead to another."

### **Components**

As is clear from the above definitions that some authors have approached creativity in terms of a product; others in terms of a process, or a kind of a person and still others have defined it in terms of personality development, at least five components of creativity have been pointed out: (i) the act; (ii) the process; (iii) the object; (iv) the person; and (v) the environment.

### **The Act**

It is very difficult to describe accurately the creative act. It is indescribable because of its very nature. The creative act is hypothesized as unknowable until it occurs. Generally we assume that creative act occurs when the organism is open to experience inwardly and outwardly and when it is ready to try out all sorts of relationships in a flexible way.

The organism, thus, out of this multituded of half-formed possibilities selects either the one which most effectively meets an inner need or that one which forms a more effective relationship with the environment. Rogers (1954) emphasizes certain qualities that are associated with a creative act. In almost all the products of creation we

note a selectivity, or emphasis, an evidence of discipline, an attempt to bring out the essence. The artist paints surfaces or textures in simplified form, ignoring the minute variations which exist in reality. The scientist formulates a basic law of relationships, brushing aside all the particular events or circumstances which might conceal its naked beauty. The writer selects those words and phrases which give unity to his expression. We may say that this is the influence of the specific person, of the 'I'. Reality exists in a multitude of confusing facts but it is 'I' who give a structure to the relationships to reality. All have their own ways of perceiving reality but it is this disciplined personal selectivity which gives products their creativeness.

To be creative, the individual must undergo certain unique experiences, the first experience the individual is experiencing is Eureka feeling—'this is it' 'I have discovered! and this is what I wanted to express!'

Another experience which an individual meets is the anxiety of separateness. It is believed that many creative products have been formed with the feeling of loneliness that 'I am alone'. They feel that perhaps no one has ever done this job before. The next experience which usually goes with creativity is the desire to communicate. It is doubtful whether a human being can create, without wishing to share his creation. It is the only way he can assuage the anxiety of separateness and assure himself that he belongs to the group. But he does not create in order to communicate, but once having created he desires to share this new aspect of himself in-relation-to-his environment with others.

Hallman (1963) says that the creative act is a whole act, an unitary instance of behaviour which terminates in the production of distinctive forms of living. The creative act evolves out of certain mental processes and it covaries with specific personality transformation. Bruner (1962) says that to be called creative, the act must grow out of a combinatorial activity—placing of things in new perspectives.

## **The Process**

The second component of creativity is the process. It is the

emergence in action of a novel relational product, resulting out of the uniqueness of the individual on the one hand and the materials, events, people or circumstances of his life on the other. The creative process generally comes out with product which is novel. It grows out with the unique attempts of the individual. Sometimes he combines or rearranges old things in a manner that they are unique and give birth to a novel object or something produced is felt new that has not been experienced by the people. The product is characterised novel because of the circumstances and the people who are to use it or enjoy it.

The product does not happen all at once rather it takes the creator a lot of time to produce. The creator usually experiences of passing through many stages and phases, of putting in many attempts and trials on making it. For example, any book first of all takes the shape of a manuscript which needs revision many times at the hands of the creator in order to reach the final shape of the book. Similar process goes on in making out any painting or any creative product.

Process is often obscure, unknown, unperceived and un verbalized even by the person himself. It has been observed that even the creator does not feel any presence of the process. Though he does not perceive it but still then something is going on. The process cannot be evaluated or measured, therefore, the creator does not perceive it. We go on playing with different fantasies or dreams. Unless something tangible comes out of it which we can see, experience or enjoy we cannot talk about any on-going process. Though fantasies may be extremely novel, they cannot usefully be termed as creative unless they eventuate in some observable product. Unless they are symbolized in words, written in a poem or translated into a work of art or some invention they cannot be taken as products.

Every produced object is the result of a phased process but in regard to creativity it goes on in the unique manner. The main characteristics of a creative process given by Rollo May are explained briefly as under:

### **The Encounter**

Every creative act is associated with an encounter. All persons who

are creative, experience first of all, an encounter. Take the example of an artist, he encounters the landscape he intends to paint. What he does first? He first of all, looks at it—observes it from this angle and that angle. He gets absorbed in it and then starts working on it. Similarly, writers encounter with the ideas and begin to draw an outline. Scientists also make an encounter—they confront their experiments, laboratory and the apparatuses.

It is not only the encounter which makes possible the creation of novels rather it should accompany engagement. By engagement we simply mean the absorption on the part of the creator. The should get involved in the task or absorbed in it. There are two types of creative persons-pseudo/Escapist creatives, and genuine creatives. What makes them different? It is only the encounter which makes one to be an escapist and other the genuine one. One lacks encounter and the other is fully absorbed in it. The escapist creative lacks engagement whileas the genuine creative faces challenge or encounter.

## **(ii) Intensity of the Encounter**

Genuine creativity is characterized by an intensity of awareness—a heightened consciousness as to what extent one is caught up or involved in the act. It does not mean partial involvement but the whole involvement of the creator in the act. This intensity of awareness is not necessarily connected with conscious purpose. It may occur in reveries, in dreams or on unconscious levels. The unconscious insights or the answers to problems that come in reveries or dreams do not come in the areas in which one is not interested. They come only in those areas to which the person is intensively committed in his conscious living and for which he has worked very hard and with dedication—consciously. This points to the fact that both unconscious as well as conscious levels are involved in the creative act. The unconscious as has been said supplies the surge and the power, the imagery and the concreteness, the ambiguity and conflict whileas the rational (conscious) level provides the elaboration, the testing, the gestalts, the socially derived approvals.

Various writers have analysed the stages through which the creative thinker moves in arriving at a creative production. Graham Wallas in 1926 identified four distinct stages to describe the creative

process.

### **(i) Preparation**

It is referred to as the period of accumulating necessary factual knowledge, skills or basic ideas. This stage is subject to the conscious control on the part of the creator. During this period, one becomes conscious of the problem and collects the necessary material and information. There is, however, no guarantee that adequate preparation will lead in generating of creative ideas but one thing is sure that a person without this preparation will not have such ideas.

### **(ii) Incubation**

It refers to the period of time following preparation in which false leads, incorrect solutions may be forgotten. It is, in other words, the period of relaxation-turning attention away from the problem. During this period some kind of unconscious activity is going on although he may seek relaxation from conscious effort.

### **(iii) Illumination**

It is a descriptive term for the flash of insight when the new combination of ideas occurs and is recognized as what was being sought. It is marked with the sudden realization of a solution to a problem. During this period, the meaningful material comes to forefront and includes the psychological events and accompany the appearance of flash of insight.

### **(iv) Verification**

The period during which the solution is tested and refined is called verification. It also includes evaluation and revision which are conscious elaborations of the crucial insight after it has occurred. It involves the testing of the new insight against some evidence to see whether it holds up as in the case of a scientific innovation. Thus, this is the period in which the produced object gets the final form after testing the validity of the concepts.

Rossman (1931) has given seven stages of the creative process. They are: (i) observation of a need or a difficulty, (ii) Analysis of the need, (iii) Making a survey of all the available information (iv) Formulating all the objective solutions, (v) Making a critical analysis of those solutions (vi) Birth of a new idea—an invention and (vii) Experimentation to test the most promising solution.

Osborn (1953) has also given seven stages of a creative process leading to a creative product. They are:

- (i) Orientation — Getting awareness of the existence of the problem.
- (ii) Preparation — Gathering relevant and pertinent data.
- (iii) Analysis — Breaking down the relevant material into parts.
- (iv) Ideation — Collecting divergent ideas as alternatives.
- (v) Incubation — Modification or change of information unconsciously.
- (vi) Synthesis — Putting up the pieces of information together to prepare a whole.
- (vii) Evaluation — Judging the result.

However, in 1974, Stein has pointed out that the creative process passes only through four stages: (i) Preparation, (ii) Hypothesis formation, (iii) Hypothesis testing, and (iv) Stage of communicating the results to eventuate into a product. Whatever the stages, one thing is largely agreed that every product is the outcome of various stages through which it has to pass in order to eventuate into the observable object.

## **The Object**

The third component of creativity is the object which is generally referred to as the product. A product may be a physical object just like an article or it may be theoretical system of the design of a mechanical linkage which is independent of its representation in a particular physical diagram. The product may be an equation or something else but its importance largely is in reference to the input costs that are to be



taken into account while judging the object produced. When we are describing a creative person, may he be an artist or a scientist or any other, we ask how much he has contributed and what quality of material he has produced. Here we are not asking simply of the quantity but quality is emphasized. This quality is referred to as the originality related to the object produced. Originality generally is associated with four main characteristics—novelty, unpredictability, uniqueness and surprise.

### **(i) Novelty**

Novelty means “newness”, “freshness”, inventiveness”. Guilford (1950) used the terms such as ‘cleverness’ ‘remote associations’ and ‘uncommonness of responses’ to denote originality in his factor-analytic approach. Morris Cohen has said that the most original ideas are nonsense because all sensible ideas have some non-original connection with previously existing facts or relationships.

### **(ii) Unpredictability**

Unpredictability refers to the quality which perhaps has never existed in the world before and which cannot be predicted on the basis of prior configurations of events. Thus, unpredictability refers to the incompatibility of creativity and theory of causality which asserts that the creative product has no causal connection or is not causally related to any object in the world and does not depend on the existence of other objects.

### **(iii) Uniqueness**

Uniqueness asserts that the products which are original have no precedent. In other words, we can say that the creative product differs from other products.

### **(iv) Surprise**

Surprise refers to the psychological effects novel combinations upon the beholders. Bruner (1962) meant by surprise as an ordering of

elements in such a way so as to find a new relationship in them that was not obvious before or grouping them in such a way that did not exist before it. For him, surprise need not to be rare or bizarre but it should accompany the quality of obviousness when it occurs, it produces a shock of recognition. Surprise leaves psychological effects not only upon the beholder but the creator also gets psychologically effected—he is marked by states of exhilaration or thrill.

### **The Person**

The fourth component of creativity is the person. The person is explained in terms of the condition of self-actualization with reference to the theory of personality of Maslow. The basic idea on which Maslow developed his theory is the hierarchy of needs. At the lowest level are the physiological needs. A number of people function only at that level. At the highest level are the selfactualizers who have growth motive in them. They rise above the general run of the people who have an integrated and wholesome personality, ultimately realize the purpose of life. During this process, the person experiences varied experiences and finds himself in the 'peak-experience' the essential aspect of which is integration within the person and also between the person and the world. In these states of being, the person becomes unified; for the time being, the splits, polarities, and dissociations within him tend to be resolved; the civil war within is neither won nor lost but transcended. In such a state, the person becomes far more open to experience and far more spontaneous and fully functioning, essential characteristics of self-actualizing creativeness (Maslow, 1959). From this point of view creativity involves a fundamental change in personality structure which occurs during the course of its fulfilment.

Rogers (1954) points out that the mainspring of creativity is the man's tendency to actualize himself, to become his potentialities. For him a creative person is a fully functioning person whose unique capacity of awareness is functioning freely and fully. When man is less than fully man — when he denies to awareness various aspects of his experience— then indeed there is reason to fear him and his behaviour. But when he is most fully man, when he is his complete organism, when awareness of experience, is most fully operating, then he is to be

trusted, then his behaviour is constructive. It is not always conventional. It will not always be conforming. It will be individualized but it will also be socialized (Rogers, 1953b).

Anderson (1954) points out that psychologically the human infant has a built-in programme for self-differentiation, for being himself, for self-actualizing. He does not have a similar built-in system for achieving harmony with others. Though he may have an inborn need for social integration, he can achieve it only through social interacting and social learning. For him creativity as personality development is not only a product of openness in human relating; it is a further opening to higher levels of harmony in the universe.

While discussing the criterion of self-actualization, Hallman (1959) identifies creativity with self-formation, and suggests that unless significant transformation occurs in personality during an activity that activity will fall short of the creative. He points out this criterion asserts a connection between motivation and creativity, for the self-actualizing person is characterised by an unusually strong motivational drive. He does not get easily frightened by the unknown, the mysterious the puzzling, and often is attracted by it.

### **The Environment**

The fifth component of creativity is the environment. Hallman (1963) discussed environment as the condition of openness which refers to the inner, the outer, the personal, and the social characteristics of the environment which facilitate the creative person to move from the actual state of affairs towards solution of the problem. According to Lasswell (1950), the environment serves as a facilitator or as restrictor both in the innovation process itself and in the process of discovery and recognition of the innovation. Mead (1956) discussed creativity in cross cultural perspective. She analyzed the relationships between the forms provided by a culture and the creativity of the individuals within the culture.

While discussing the environment and creativity, Rogers (1957) has beautifully remarked that the tendency "to actualize himself" exists in every individual and awaits only the proper conditions to be

released and expressed''. He stresses the following conditions in the individual are closely associated with a creative act: (i) Openness to experience. In a person who is open to experience, each stimulus is freely relayed through the nervous system, without being distorted by any process of defensiveness. Openness to experience also refers to the tolerance for ambiguity, ability to receive such conflicting information without forcing closure upon the situation. The more the sensitive awareness the individual has available to himself during the various phases of his experience, the more sure it will be that his product will be creative; (ii) The second condition associated with the creative act is the source of judgement for evaluating the product be internal. It is the creator who establishes the value of his produced object and not the beholder who may simply shower praises or criticises it. If the person feels that whatever he produced satisfied him, then he has produced something creative. Besides the internal conditions there are some external conditions that help in fostering creativity. Among them "psychological safety" and "psychological freedom" are of paramount importance.

Dow also stresses that the self-actualization is the first and foremost characteristic of a creative person. He has made it clear that there are some outside influences or forces that prevent creativeness or prevent anyone from becoming a complete personality. The most dreadful force is the conformity that hampers creativity among individuals. Many other authors also hold consensus that the environment serves as a facilitator or as a restrictor of individual creativity. Eyring (1959) enumerated environmental facilitators of creativity in chemistry laboratories. Hilgard (1954) discussed some programmes that can be of a great help to students at college level to foster creativity in them.

### **Levels of Creativity**

Some researchers have thought it necessary to consider levels of creativity in understanding the concept of creativity. Taylor (1959) differentiates between the various levels at which the individual may be creative. He suggested the following five levels:

**(i) Expressive Creativity**

This is the first level of creativity. It involves independent expressions where skills, quality and originality with respect to the object produced are not very important. The expressive creativity is mostly exemplified in the spontaneous drawings of children.

**(ii) Productive Creativity**

This level of creativity calls for some production but the object produced need not to be distinguishable from the products of others. It is mostly involved in artistic or scientific products where there are restrictions and controlled-free play.

**(iii) Inventive Creativity**


At this level of creativity, ingenuity is displayed with materials, methods and techniques. The inventors, explorers and discoverers who employ new uses of old parts or seek new ways of old things are the examples of using inventive creativity in their production.

**(iv) Innovative Creativity**

This creativity is based upon highly developed abstract conceptualizing skills. Those who make significant modifications in the basic foundations are said to be using innovative creativity.

**(v) Emergent Creativity**

It is believed to be the highest level of creativity. It requires ability to absorb commonly provided experiences and produce something unique. The produced object may be either an entirely new principle or assumption around which new schools or movements can flourish. Taylor pointed out that many people have the fifth level in mind when they talk about creativity because this level is very rare whereas the other lower levels usually have been involved in most investigations regarding creative behaviour.



## **Traits of Creativity**

Researchers generally agree that the discussion on the nature of creativity is incomplete if the knowledge of traits that go along with creative potential is not understood. Researchers have shown that it is the combination of intellectual factors and personality traits which distinguish the creative person from others. It is Guilford and his associates who first of all started scientific investigation of the traits that make up what we now term creativity. It is he who made the distinction between two types of thinking abilities—one leading to intelligence is termed as convergent thinking and another leads to creativity is called as divergent thinking.

### **Convergent Thinking**

Guilford defines convergent thinking as “it involves thinking towards our right answer or towards a relatively uniquely determined answer”. This type of thinking proceeds towards a restricted answer or solution. For example, if anybody is asked to give the opposite of low, he would probably respond with ‘high’. Thus, in this ability, the solution is determined by the given information, or where the information leads to one right answer or to recognized best conventional answer. This thinking ability mainly represents the analysis and integration of given or remembered information.

### **Divergent Thinking**

Guilford defines divergent thinking as “a kind of mental operation in which we think in different directions, sometimes seeking variety from known and remembered information”. It is a type of thinking in which considerable searching—about is done and a number of answers will do. Unlike convergent production where the information leads to one right answer or to a recognized best conventional answer, divergent production leads to novel responses to stimulus object.

The unique feature of this type of thinking is that a variety of responses are produced.

Guilford relates divergent thinking to certain well-known traits

which seem to go with creativity. He defines trait as any distinguishable, relatively enduring way in which one individual differs from another. He has made a mention of two types of traits---aptitude traits and non-aptitude traits.

### **Aptitude Traits**

These are primary traits related to creativity. These traits are found by factor analysis. It is believed that the following traits are related to the aptitude for creative thinking.

#### **(i) Sensitivity to Problems**

It is an ability which is reflected in a person's detecting something which is missing or lacking in a given situation or needs some improvement. This trait is best indicated by tests asking examinees to state defects or deficiencies in common implements or in social institutions or to state problems created by common objects or actions. It is this observation of imperfections which give a start to a creative person towards a creative production.

#### **(ii) Fluency of Thinking**

This is considered as a quantitative aspect of creativity, i.e. coming up with a large quantity of ideas, words, and ways of expressing them. There are four factors associated with fluency of thinking such as, word fluency; associational fluency; expressional fluency and ideational fluency.

### **Word Fluency**

This is an ability to generate words containing a specified letter or combination of words. It involves a requirement of words only and is best called a test of vocabulary.

### **Associational Fluency**

This ability involves a requirement of meaning for the words

given and not only the generation of words within a fixed time limit. This ability asks for generating associations or relations, production of analogies, or similarities.

### **(i) Expressional Fluency**

This ability involves the production of phrases or sentences. This ability is needed in both the writing and in oral speech. It is believed that any piece of writing is judged best by the arrangement of words in sentence structure and the way one expresses himself indicates the extent of creativity in him.

### **(ii) Ideational Fluency**

This trait is of wider usefulness as it involves production of ideas. This is the ability to generate ideas to fulfill certain requirements within a limited time. This ability calls for quantity, i.e. here quality is not evaluated and it is only the quantity which is important consideration.

### **(iii) Flexibility of Thinking**

Flexibility is referred to as thinking up a variety of ideas and new ways of dealing with situations. It indicates how an individual can respond in different distinct ways to a stimulus. It can best be termed as a measure of variety. It differs from fluency in the way as fluency calls upon the generation of ideas or fertility of ideas but flexibility does not involve only generation of ideas but the variety or different thought trends in the generation of ideas. It is manifested by two abilities—spontaneous flexibility and adaptive flexibility.

### **Originality**

The originality has been approached differently. It has been viewed through different perspectives. It is designated as uncommon with respect to figural, verbal or symbolic transformations. It is designated statistically as unusualness of responses or infrequent. Some tests call for remote associations or relationships; remote either in time or in a logical sense. Always we see that examinees give two types of



responses—obvious and remote. Obvious indicates ideational fluency while as remote indicates originality. There are various terms that are used for originality such as, uncommon, unusual, clever, novel, unique, infrequent.

### **Redefinition**

It is an ability which calls for to give up old interpretations of familiar objects in order to use them or their parts in some new way. The examinees are required to define or perceive the problem in such a way that is different from the usual, or established way. Here, the emphasis is on the ability of rearranging ideas, concepts or objects or to indicate the use of parts in new ways. Improvising, in general, probably reflects the ability of redefinition.

### **Elaboration**

This ability is indicated by production of detailed steps, variety of implications and consequences that can be measured quantitatively. Expanding and combining activities of higher thought processes are involved in it. Guilford (1950) has demonstrated this ability by giving examinee one or two simple lines and told to construct on this foundation a more complex object. The score is the amount of elaboration. It is also indicated by a test in which the base outline of a plan is given and the examinee is asked to list all the minor steps required to make the plan work. Here, he is required to use two types of abilities pertaining to elaboration of figural material and elaboration of meaningful material.

### **Non-Aptitude Traits**

Besides, the aptitude traits there are non-aptitude traits related to creative performance. The traits of motivation and temperament are believed to have determining effects upon whether or not an individual exhibits creative performance. Anne Roe (1946 and 1953) conducted a series of studies on leading artists and leading scientists in several fields, and she arrived at the conclusion that one trait namely willingness to work hard and to work long hours; stood out in common

among individuals.

Guilford has shown through factor analysis that at least three primary traits of interest in different kinds of thinking including interest in reflective thinking, rigorous thinking and autistic thinking are related to creative performance. He had also found a pair of primary interests, namely, aesthetic appreciation and aesthetic expression that are related to creative performance.

Another factor that has been found to be related to creativity is 'tolerance of ambiguity'. This is a willingness to accept some uncertainty in conclusions and a tendency to avoid thinking in terms of rigid categories. The original person tends to be more tolerant of ambiguity and to like reflective, and divergent thinking and aesthetic expression. In addition to these traits, Guilford has exhibited other non-aptitude traits of self-confidence, social boldness and self-sufficiency related to creativity.

To conclude, research about the nature of creativity reveals that creativity is not a unitary trait but a complex of so many discrete abilities and personality traits. Second, that successful creative performance, to the extent that it depends upon aptitudes, is not equally promising in all the fields of endeavour. "Potential for creative production in the arts is not the same thing as that in mathematics or that in writing, to say nothing of potential for creative handling of problems involving human relations". (Guilford, 1962).

### 3

## Theories of Creative Performance

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Various psychologists and philosophers have attempted to answer certain questions related to creativity, such as, the nature of creativity, creative functioning or creative behaviour, and process of creativity. Their answers to these questions constitute different theories of creativity. Some theories are based upon simple assumptions whileas some have undergone empirical validations. At one time, creativity was equated with cosmic life based upon the Darwin's theory of evolution. According to this notion, human creativity was considered as manifestation of creative force inherent in life, in organic matter and it was this force that continuously brings forth new productions as are often unique and unprecedented. These productions follow the life cycle-taking birth, developing and finally perish. But such a type of notion regarding creativity as natural has been challenged recently and now more emphasis is laid on the development of creativity that can be fostered through well-planned techniques and methods. Some well known theories of creative performance are enumerated here.

### **Divine Inspiration Theory**

Some philosophers have considered creativity as divine inspiration. They quote Plato as saying that a creative writer finds it difficult to exercise enough of control over himself when he writes anything. Plato considers the writer as an agent of some higher power. It is only the higher power which makes him capable of producing anything creative. Tagore also confesses in Gitanjali that "I am a dead reed, but you make it a flute by blowing various tunes through me over valleys and hills".

Whether it was a divine inspiration or not, which enabled Poincare (1913) to discover the existence of fuchsian functions into

Mathematics is presented here. It is said that he had been struggling for days with the problem of functions but could not reach any conclusion. On night after taking black coffee and being unable to sleep, ideas rose in his mind, he says, in crowds, colliding sometimes interlocking, and finally making some stable combinations from which he discovered the existence of the Fuchsian functions. Shortly afterwards, while on a geological excursion and with no thought of mathematics in his head, as he put his foot on the stop of an omnibus, the idea flashed into his mind that the transformations he had used were similar with those of non-Euclidean geometry.

Another notable example often cited is of the solution of a scientific problem without conscious effort is of Otto Loewi's proof of the chemical mediation of nerve impulses. This came to him vividly in a dream and the next day he performed the critical experiment in his laboratory that proved the truth of the solution given to him.

Most of the creative artists especially poets have often experienced that there is some invisible power that makes them to create something new. Houseman (1933) in his essay on 'The Name and Nature of Poetry' describes how his verses often arose in his mind. He says, "As I went along, thinking of nothing in particular, only looking at things around me, there would flow into my mind, sometimes a line or two of verse. sometimes a whole stanza at once. accompanied. not preceded, by a vague notion of the poem which they were destined to form part of. Then there would usually be a lull of an hour or so, than perhaps the spring would bubble up again". Robert Frost had also experiences such as these. One evening in winter, the poet had opened his front door and strode out into the snowy darkness for a breath of air when there came into his mind the whole of that poem 'stopping by woods on a snowy evening'.

Sinnot says that such inspirations rarely come unless an individual has immersed himself into a subject. He must have a rich background of knowledge and experience in it. In science, he must be labouring to find the answer to a problem or to bring a mass of apparently unrelated facts in his mind into aunity; in art, he must be pondering about a piece of music or painting which he feels is there but cannot quite be brought into existence; in poetry he has an intense

preoccupation with something beautiful but still vague which he is eagerly trying to express. He is wrestling to bring into actuality the cloudy half-formed products of his imagination. Sometimes, the whole answer to a problem may appear or the outline for a story or a verse but more commonly the initial inspiration is only the start and needs long hours or days of labour to be followed in reorganising the original flash of insight but one thing is certain that without this flash the creative process might never have been able to get started.

### **Accidentality Theory**

It is believed that so much creativity is nothing but the result of accident or chance. Any artist whether he be a scientific inventor or painter, or writer is the one who can most often put himself in readiness for the 'accident'. The artist holds himself open for the lucky accident. Accident is not the right term, rather a myriad of different possibilities exist, and out of these one is born.

Arthur Koestler made a study of the great scientists of Renaissance and brought out the report in the book 'The sleep walkers'. In this book, he lays special emphasis on the seemingly irrational slips and errors which actually helped Copernicus, Galileo and Kepler in formulating their theories. The accidentality is found in most of the productions both in science and arts. Such experiences have been experienced by Claude Bernard while discovering the relationship between electricity and magnetism. Galvani's discovery of electric effects in living tissue and Pavlov's discovery of the conditioned response are also assumed as accidental creations. It is also believed that at times luck favours the person (Connon, 1940; Mclean, 1941).

Though this theory fails to provide any sound scientific bases of explanation, however, one thing comes to fore that no creation is possible unless one is intensely interested and motivated in it. No doubt, chance plays its role but it is only sustained hard-work which makes any creation possible.

Besides the theories discussed earlier, there are some personality theorists who have attempted to explain creative behaviour in their personality theories. These theories are generally grouped into three

major streams of psychological thought which explain creative behaviour:

(1) Psychoanalytic, (ii) Humanistic, and (iii) Behaviouristic. Psycho-analysts view creativity as somehow stemming from the unconscious, or in some cases; the pre-conscious. Humanistic theories typically relate creativity to the individual's striving for self-actualization. Behaviourists recognize creativity as novel or unusual behaviour which is nevertheless a learned response fundamentally not different than other behaviours and explainable in stimulus-response terms. No doubt, humanistic theories find some common ground with psycho-analytic theories so far unconscious as a source of creativity is concerned but still they differ. All the three psychological traditions differ in regard to "the extent to which the creative process is seen to be under cognitive control continues to be an emotionally laden issue-related no doubt to one's reference groups". (Helson and Mitchell, 1978).

As Rchalak (1968) stated: At heart is the image of man which is at issue in psychology's internal conflict—How shall we theorize about the human-being? Shall we say that he can think, or not? Can he grow personally and rise about his environment or not? Can he respond to the opportunity for independent action by taking responsibility, or not? Let us see what the following theories say regarding this.

### **Psychoanalytic Theory**

Freud, the father of psychoanalysis was the first who attempted to analyse the intricate process of creativity. Freud and his followers lay special emphasis on the repressed unconscious wishes, the pregenital and libidinal urges, the sublimation of which largely determines creativity. They view an artist as a successful neurotic who finds outlet of his unconscious conflicts through sublimation—a process in which instinctual forces are redirected into disguised, socially acceptable channels. Thus, creativity, according to Freud owes its origin to conflicts within the unconscious mind. Some believe that conflicts are harmful and hence should be avoided which is not true. Conflicts are the source of wondering, of the development of strength for personality. If one avoids conflicts he becomes a smoothly running machine where

every affect is immediately levelled off, where all desires become automatic and where all feelings become flattened out. To be aware of the conflicts, to experience them deeply, to accept them not just intellectually but in feeling, is one of the conditions of creativity (Fromm).

For some writers and artists, the themes that haunt them and from the content of their creative efforts are in a large measure autobiographical and in that sense reflect their own unresolved conflicts. This was apparently the case with Eugene O'Neill whose 'conscious' autobiography appears in the play 'Long Day's Journey into Night', whereas his 'Unconscious autobiography' is perhaps revealed in 'Desire Under the Elms (Weisman, 1957)'.

How to solve these conflicts—the Unconscious comes to our rescue which succeeds in finding out appropriate solutions to these conflicts. The solutions which reinforce the activity intended by the ego are believed to release creativity whereas the solutions which do not reinforce an activity intended by the ego, are repressed and emerge as neurosis. Therefore, creativity and neurosis are teaced from the same ground. This view is supported by an old theory which states that the superior creativity is a kind of creative madness or at least creative instability.

According to Freud, creativity helps a conflict-ridden person in releasing his inner conflicts. For him, a neurotic is an artist *san art*, i.e. a neurotic is that artist who has not created art. The term, Freud, used to describe this phenomena was catharsis. The same expression we find in Kohut (1957) when he describes music as mostly cathartic experience which is in fact a process of sublimation. Musical experience and musical creativity bring in a sublimated and disguised release of tension within the individual. Femichel (1946) also finds the same very process operant in dramatic arts. He sees in the acting of the actor as a direct narcissistic satisfaction which the actor derives from the appreciation of the audience and it also brings in him a satisfaction to his self.

The focal points around which psychoanalysis, perhaps, revolves are the conflicts and unconscious. So far we have discussed the importance of conflicts regarding creativity as attached to it by psychanalysts, now we shall look at the another point which is more

important-unconscious. It is in dreams and half-dreaming states, the mind is filled with a throng of images and fantassies. The whole unconscious presumably is occupied with such images and fantasies and their source can be traced in memory and the experiences of the past and perhaps also directly in the processes of life itself. It is the place where matter, life and mind are most inextricably mixed and where the natural tendencies come to expression and the new patterns of the unconscious mind are created. For instance, when any individual ponders over a problem and seeks to solve it in his conscious mind. Among the throng of images and ideas, the unconscious mind rejects certain combinations as unimportant or incompatible but sees the significance of others. By doing this, the unconscious mind is able to solve problems and to lay at least the foundation for the creation of any new object. In order to create something, the unconscious requires as incentive or a goal to be achieved. It is, thus, a conscious desire for something, may be some work of art or some discovery or some scientific theory or anything else for which he seeks and wants to reach expression.

The others who attempted to further this theory are Kris (1952), Kubie (1958), Greenacre (1957), and others. Kris and Kubie emphasize the importance of preconscious processes which are belceved to occur when the ego lessens its control on the rational thinking process so that an organised drive-oriented- type of thinking occurs. They believe that it is at this preconscious level of thinking that facilitating associations between the ideas related to immediate problem and apparently unrelated but potentially useful ideas are likely to occur, such ideas are also based on the day dreams and fantasies in which an individual gets himself absorbtbed. Thus, for Kris, creativity is a 'regression in the service of the ego' by which he meant that in all creative thinking ego achieves some measure of control over the primary processes. Kubie also supports Kris's idea regarding the use of preconscious and not of unconscious mental mechanisms in the creative act. He believes that both conscious as well as unconscious mental activities hinders creative activity because of its 'anchorage to reality' and the unconscious because of the 'rigid use of symbolic functions'.

Greenacre (1957) who also worked within the Freudian framework believes that the ego in the creative act dissociates itself



from the real objects and develops its own fantasy with the world. He lays more emphasis on sensitivity to sensory stimulation which is, for him, a pre-requisite condition for creativity. Influenced by Greacre; Weissman (1967) believed that because of the intensified sensory stimulation, the creative infants even hallucinate real objects. He, thus, substituted Kris's concept of 'regression in the service of the ego' by 'dissociative functions of the ego'.

Freudians also view that creativity is a recapitulation of early childhood experiences. According to Hillgard (1959) Einstein was often seen sitting around the house with uncut hairs in his bathrobe and slippers, in behaving in some respects like a child who needs to be taken care of. Merton (1957) has also discussed Newton's heated controversy with Leibniz over the priority of invention of calculus, and other childish behaviour of scientists. Charles Darwin is said to be a prey of psychosomatic symptoms. Thomas Mann referring to Goethe is quoted as commenting upon "The Union is one human being of the greatest intellectual gifts with the most amazing naivete".

### **Compensatory Theory**

Adler (1927) emphasizes the compensatory drive in the creative person which makes him to create. According to him, human beings produce art, science and other aspects of culture to compensate for their own inadequacies. Adler believes that the race of man as a whole developed culture and civilization to compensate for his relatively weak position on the earth. Many great creatives have created perhaps to compensate for their inadequacies, for example, Beethoven was a deaf person Van Gogh was psychotic and Gauguin seems to have been schizoid. The similar view has been put forward by Rank (1932) who conceived of a desire in the artist to immortalize himself. This theory, emphasizes either on the inferiority, inadequacy or guilt feelings of the human being which drive him and make him to compensate and in the process of compensation, something original he brings about so as to fit himself in the culture.

Jung (1938) is another very important theorist whose contribution to creativity is quite substantial. According to Phillipson (1963), Jung viewed creativity at two levels; (i) the psychological mode, and (ii) the

visionary mode. In the psychological mode, the content is mainly derived from the domain of human consciousness, in relation to family environment, society, and other social institutions but the release of creativity does not transcend the limits of psychological intelligibility. In the visionary mode, the content is derived not from the life experiences but from the timeless depths which Jung called the "Collective Unconscious". According to Jung, the visionary mode in creativity is not subject to the conscious control of the individual. Sometimes, such a person experiences an 'alien will' beyond his comprehension. It might be for this reason that the great work of art transcends the life experiences, personal factors and historical periods in which such an individual happens to live.

### **Motivational Theory**

A group of motivation theorists have emphasized that creativity is effected by innate orientation, drive or urge such as, drive of self-actualization (Goldstein, 1939, Rogers, 1954; Maslow, 1959). They believe that man's basic motivational tendency is towards self-actualization or self-fulfillment. Maslow points out that man's other goals centre around what he lacks or needs, such as food, safety and human solidarity. These goals, according to him, are prerequisites to self-actualization because a person must first satisfy his lower-order needs before he strives for the development of his individuality or the realization of his potentials.

Creativity for, Maslow, is a maximum of self-actualizing. According to him, self-actualizing creativeness stresses first the personality and then its achievements considering these achievements to be epiphenomena emitted by the personality and therefore, secondary to it. It is emitted like sunshine it spreads all over the place, it makes some things grow (which are growable) and is wasted on the rocks and other ungrowable things. He classifies creativity into primary, secondary and integrated types with reference to the use of primary and secondary processes. For him self-actualizing people are highly motivated as they are relatively unfrightened by the unknown, the mysterious, and the puzzling. They selectively pick it out to puzzle over, to meditate on, and to be absorbed with.

For Rogers, motivation is the mainspring of creativity. It is a tendency within a man to actualize himself, to become his potentialities, and to express and activate all the capacities of the organism, to the extent that such activation enhances the organism or the self. According to him, this tendency exists in every individual and awaits only the proper conditions to be released and expressed. Thus, creativeness is an emergent property of the individual and as supposed by plant (1929), the need for self-expression is the most important universal determinant for creativity, though certain favourable conditions are necessary for its release. Rogers stresses the three inner conditions for creativity; (i) openness to experience; (ii) an internal locus of-evaluation; and (iii) the bailability to toy with elements and concepts.

Motivation may be intrinsic or extrinsic but both are necessary conditions to creativity. It has been observed in the researches that most of the creations and discoveries of great social value have been motivated by purposes having more to do with personal interests than with social value. The individual creates primarily because it is satisfying to him as this behaviour is felt to be self-actualizing. Thus, it is intrinsic motivation which helps rather forces an individual to create something new. He has the urge to expand, extend, develop and mature. People differ in their intentions to create new productions. Scientists create in order to improve things and seeing needs (Rossman, 1931) whileas artists create to fulfill their urge to do something different (Hadamard, 1945). Some people create as they prefer complexity over simplicity. But, in all cases, one can produce only in accordance with his intellectual capacity and potential.

Creations differ in as far as their social utility is concerned. There are people whose creations are of social utility whileas the creations of others are destructive in nature. For example, one man may be discovering a way of relieving pain, whereas another is devising a new and more subtle form of torture for political prisoners. Both these actions are creative but their social value is very different. Now, the question arises whose creation will be regarded a creative one? To answer this question, we shall have to define the behaviour of the creator. It has been found that when the individual is "open" to all of his experience, then his behaviour will be creative and his creativity may be trusted to be essentially constructive (Rogers, 1953). In other

words, when man is less than fully a man-when he denies to awareness various aspects of his experience then indeed we have all too often reason to fear him and his behaviour, as the present world situation testifies. But when he is most fully a man, which he is his complete organism, when awareness of experience, that peculiarly human attribute, is most fully operating, then he is to be trusted, then his behaviour is constructive. The product may be pathological or socially evil if it comes from the individual who is denying to awareness some areas of his experience whereas the product may be constructive both for society and the creator himself if the creator is open to all aspects of his experience.

Hennessey and Ambile (1982) have demonstrated that creativity will be maintained when intrinsic motivation is maintained and it will be undermined when intrinsic motivation is undermined. They report that those children who had received intrinsic motivation training exhibit higher creativity when rewarded than when not rewarded. Deci and Ryan (1985) are also of the belief that the impact of an event on motivational processes is determined not by the objective characteristic of the event but rather by 'its psychological meaning for the individual'. Thus, it can be safely concluded that the intrinsic motivation is conducive to creativity without which it is perhaps impossible for any individual to create anything new. What motivates him to create depends upon the situation on the one hand and tolerance for ambiguity, and urge to satisfy his self on the other.

### **Theory of Association**

The theorists of Association base their theory of creativity on stimulus-response associations. They see psychological processes as essentially involving the building up of associations between stimulus and response. For them, every type of creativity results from unusual associations. The roots of this theory go back to 19th century in America and England when associationism was a dominant school of psychology and the influence of behaviourism on it. They maintain that thinking is the association of ideas. New ideas are formed from past ones by a process of trial and error. Therefore, the more association of ideas, the more creativity, they hypothesize.

Mednick is regarded the great exponent of this theory. According to him "Creative" process is the forming of associative elements into new combinations which either meet specified requirements or are in some way useful". In other words, it can be said that creativity involves the formation of associations between stimuli and responses. The process of building up these associations between stimulus and response point out the fact that the elements linked together are not normally associated. It is hypothesized that people differ in making up new associations. Some people tend to link stimulus with highly unlikely responses whereas others link stimulus with likely responses. For Mednick (1962) it is the group of divergers, i.e. the creatives who tend to link stimulus with highly unlikely responses. They dare to venture to link aspects of their environment together in an effective way though they do not really belong together as per past experience. He believes that the creative person arrives at the creative solution through three ways: (i) by chance, (ii) by similarity of the associative elements, and (iii) by the requisite elements being evoked continuously through the mediation of common elements.

On the basis of this conceptualization, Mednick developed a test of creativity—The Remote Associations Test. The degree of creativity depends on the relative remoteness of the elements, used to form the new elements. He assumes that a highly creative will make a greater number of associations to any stimulus than that of a less creative one. When creative people are asked to respond to a stimulus word, they are likely to give some remote or unusual responses whereas less creative people tend to give only usual, common, and stereotyped responses.

Some theorists have added instrumental conditioning in the S-R theory. They believe that the extent to which a child is able to make creative responses is dependent on the extent to which he has been rewarded or punished during the process of creating new things. Thus, they emphasize the role of differential reinforcement in the process of creative solutions. Maltzman and his associates report that the originality in children can be increased. He found in one of his experiments that experience in unusual uses of objects help children solve problems in new ways. According to him, giving unusual responses, is a habit that can be strengthened by reinforcement.

This theory, however, ignores the individual as an important element in connecting the environment and behaviour. According to S-R theory, individual becomes merely some kind of storage place at the mercy of the external world. In fact, whether a person functions divergently or convergently cannot be wholly traced from his conditioning history but in his characteristics as a human being whose thinking mainly depends upon both personal as well as intellectual characteristics.

### **Cognitive Theory**

Cognitive psychologists go deep into the internal process by which an individual deals with the complexity of his environment. They assume that an individual's behaviour is always based on cognition, the act of knowing about the situation in which behaviour occurs. Gestalt psychologists use the terms productive thinking and problem-solving to creativity. According to wWertheimer, peoductive thinking involves a process of successive restructuring of a problem. The structural features of the problem put the problem-solver in many stresses and strains. The problem-solver, by facing such stresses and strains, arrives at a solution, where he finds the ways of restructuring the problem. Such a solution is termed as creative. However, some theorists argue that this type of thinking is more needed in convergent problems which require one or a few right answers than to divergent problems which require many but varied solutions.

Guilford (1959) discusses the concept of creativity as a congitive ability, multivariate in nature. He through factor- analytic approach revealed quite a number of components that constitute creative thinking. He gives different names to such cognitions as divergent productions. These productions are: Fluency, Flexibility, orginality and Elaboration. According to him, the divergent production results from the material or content processed and the processes or operations performed with the material. A reference to his structure of intellect model has already been made in which each ability has been discussed fully, here we are considering their theoretical bases only. According to Guilford, when divergent production process acts upon figural contents, to bring out products of different units, classes, relations, systems, transformations,

and implications, they may be called non-verbal creativity. When symbolic and semantic contents are used they give rise to verbal creativity whereas when behavioural contents are used they exhibit the behavioural patterns of an individual as to how he deals with people around him.

Guilford, thus, analyses the nature of creative thinking ability which he equates with divergent thinking. For him, it is a type of thinking that does not follow the beaten path of conformity or convention but rather seeks for varied and unusual solutions to the problem. This concept is, thus useful from the point of view of the assessment of this unique ability in individuals. He believes that his ability can be measured with the help of tests and obtained scores can be correlated to real life achievements of the creative individuals. In 1966, he developed his most popular test of divergent thinking which provides the bases for all the tests developed in India and abroad.

Among all the theories presented there, the theory given by Guilford seems to be more rational and widely accepted theory as it provides the ground to measure creativity quantitatively with the help of divergent thinking tests. Second, the theory considers the motivational factor as an important determinant of creativity. Third, the theory assumes that every individual is in possession of creative thinking ability. Though, some may be more creative whereas others may be less creative and rejects any such dichotomy such as creative and non-creative.

## 4

# Creativity and Intelligence

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Creativity has long been recognised as an intellectual talent of great individual worth and social usefulness. However, it has often been confused with intelligence. In literature, though, the two terms carry different meanings but still then there has always been considerable interest in the relation between creativity and intelligence. Assumption is that both being to the same category of mental life, intelligence being a more general and broader term than creativity. Unfortunately, psychologists are in basic disagreement on the meaning of the intelligence. One point of disagreement is whether intelligence is to be conceived as capacity or ability. Most of those who use the term capacity or potentiality in defining intelligence convey their belief that intelligence is innate, inborn, or untaught. Those who use the term ability, on the other hand, do not commit themselves on the question of the source of intelligence and that they would argue that we observe is ability and that we cannot observe and record potentiality unless it has developed into some kind of performance.

Binet, the father of modern intelligence tests, has defined intelligence as an intellectual ability whereas Stoddard (1943) presents a comprehensive description of intelligence and states that any type of intellectual ability which undertakes activities characterised by difficulty, complexity, abstractness, economy, adaptiveness to a goal and social value is termed as intelligence and it accompanies one more attribute i.e. the emergence of originals, that distinguishes different types of intelligence at the higher and of the continuum is labelled as creativity.

Binet and those who followed the philosophy inherent in the approach considered intelligence to be a general and a unified ability.



Spearman, a British Psychologist, applied statistical analysis to intelligence test results and concluded that performance on intelligence tests was due first to the presence of a general factor and then to specific abilities. Thurstone is believed to be the first who made mention of ideational fluency (an attribute included in creative thinking) while developing a test that measured what he considered to be the primary mental abilities.

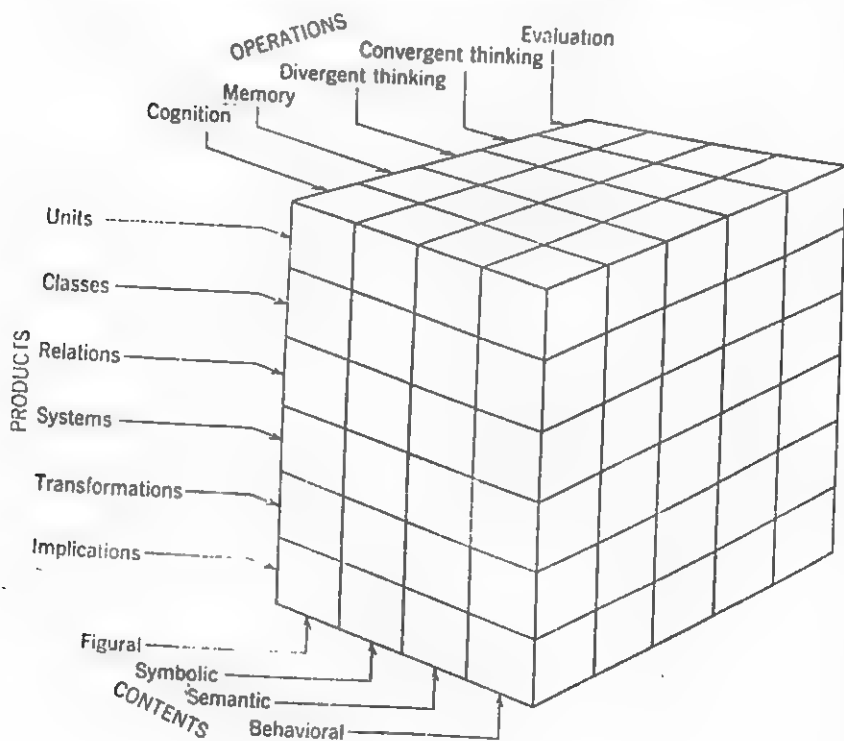
It was upto the close of the 19th Century that a notion was held that intelligence and creativity are synonymous. In one research study in 1898, Dearborn studied the imaginative responses of Harvard students on a series of inkblots and found that some of the students who were of the 'intellectual type' gave a very poor account of themselves on imaginative thinking.

In 1902, Colvin made use of his measures based on compositions with high school students. He gave attention to such factors as invention, sense of humour, imaginative power, feeling and perceptive power and found that logical power shows no pronounced relation to any type of imagination except the visual' Simpson (1922); Mecarty (1924); and Abramson (1927); also arrived at the same conclusion. In 1930, Andrews used a variety of methods and observations, to study a variety of types of imaginative or creative activity. Her conclusions have been criticised for the reason that the measures she had used, appear to be indices of convergent thinking. Markey (1935) employed observational methods to evaluate performance in a variety of standardized situations and tasks. She concluded that no single test taps all of the imaginative resources of an individual and that the same test of imagination is not equally valid at all age levels as the level of the child's understanding and comprehension influences the type of creative response. In the light of the above attempts to assess the creative thinking of younger children, there is in general a tendency for a low correlation between such measures and traditional measures of intelligence. Markey (1935) reported that the correlations between mental age and test scores were slightly higher than correlations between chronological age and test scores. Furthermore Markey concludes that relatively low correlations between mental age and imaginative behaviour are because of the diversity of groups studied and so on it was only in 1930 that Andrews recognized more clearly the difference

between the two types of measures and concluded that the correlations between I.Q. and imagination and mental age and imagination are so low as to indicate that "very little relationship exists between intelligence and the fantastic imagination of the young child". McDowell and Howe (1941), however, have reported that IQ was positively correlated with the degree of creative use of all the play materials. In 1950, Thurstone stated that there was a positive correlation between intelligence and creativity but creative talent was not the same as intelligence.

### Recent Efforts

As the above studies were of the correlational type and were at



**Fig. 4.1** Structure of the intellect.

best only suggestive. It was Guilford (1959) and his associates at the University of Southern California who for the first time gave the empirical evidence for the existence of a set of mental abilities in the 'structure of intellect' that seemed to have promise as direct contribution to creative thinking. Guilford was able to demonstrate, though the application of factor analysis technique, the presence of creative thinking abilities as distinct from intelligent thinking. It is he who brought to fore the existence of two distinct types of thinking abilities which he designated as convergent thinking and divergent thinking abilities. The convergent thinking abilities are those abilities which are mainly responsible for dealing with the given information in a logical manner in order to arrive at any single answer for any problem as found in all intelligence tests. On the contrary, the divergent thinking abilities are those abilities that enable the individual to go off in varied directions, generating new information from given information and arriving at different and unusual solutions to problems. The abilities represented under the category of divergent production are three different kinds of fluency word, ideational, associational; two kinds of flexibility-spontaneous, and adaptive; originality; elaboration and transformation. These distinctions brought to think of convergent thinking as synonymous to intelligence and is measured by traditional measures of intelligence and divergent thinking was thought of more close to creativity and is measured by tests of creativity. There are other abilities that contribute to creative performance find their place, also in a three-dimensional figure in which the primary abilities are distinguished in terms of the kinds of material dealt with, the kinds of operations applied to the material, and the resulting products. This three dimensional figure which is known as "the structure of intellect" developed by Guilford (1959) provides information about mental abilities involved in creative.

### **Creativity and the Structure of Intellect**

No doubt, psychologists have made mention in some mental abilities but it is Guilford who considered all the factors that could be regarded as belonging to the intellectual domain and proposed a system of those factors which is termed as 'Structure of intellect' He used the statistical technique of factor analysis to develop this model and found

that there are 120 abilities or factors of the mind. A factor is found by correlating various tests with each other and determining mathematically which tests cluster together along certain dimensions, the dimensions or factors having been arrived at by the method of factor analysis. He hypothesized that the human intellect was composed of a "three-dimensional" system of numerous intellectual abilities classified on the basis of (i) the material or content processed; (ii) the processor operations performed with the material; and (iii) the forms or products of the processed information (see Fig. 4.1). The figure represents the three kinds of factors by means of a cubical model. Theoretically, 120 factors or abilities can be generated from the model. Since any operation can be performed on any content and can result in any product (4 contents  $\times$  5 operations and six products).

## **Contents**

Content is the raw material to which mental process is applied. The contents are like codes or languages and the products are like words in these languages. There are four types of contents—figural, symbolic, semantic and behavioural. The first three were comprising the model of 1957 and the fourth one was added in the model of 1959.

### **(i) Figural**

Figural content is concrete material directly perceived through sense organs. It is called figural to indicate that some kind of structuring occurs or some image is formed. The figural content contains both auditory and Visual abilities which are separate and distinct. Artists, painters and designers make use of Visual abilities while as poets and dancers make use of auditory abilities. Visual objects have properties of shape, size, colour, texture, and auditory elements are in the form of rhythms, melodies and speech sounds.

### **(ii) Symbolic**

Symbolic content pertains to letters, numbers or other conventional forms and their systematic organisations. It includes signs

or labels that usually stand for other things. Things that are seen or heard and the things we think about have names and those names are another kind of information. The symbolic contents are manipulated in mathematics and in languages as both rest heavily upon the symbolic abilities.

### **(iii) Semantic**

Semantic content appears in the form of verbal meaning and interpretation. This type of material is called conceptual as it consists of meanings in verbalized form. Scientists, writers, speakers and teachers rest heavily upon semantic contents.

### **(iv) Behavioural**

Behavioural content is referred to as social intelligence—the ability to perceive and interpret the thoughts and feelings of others from their overt behaviour. It is mainly concerned with mental or behavioural events. This content enables us to know what the person is feeling, perceiving or is intending to do. This information we get from his facial expression, his bodily posture and from what he says and how he says it. Thus, this type of ability helps in understanding other individuals and coping with them. Behavioural abilities would serve well those who need to influence or manage others like teachers, speakers, judges, politicians, probation officers, police and salesmen.

The content categories, thus, provide a basis for classifying individuals with respect to their jobs, and for creative production on the one hand and abilities for dealing with different kinds of content on the other. For example, high visual figural abilities are needed by inventors, engineers and architects whileas auditory—figural abilities are needed by composers, arrangers and stylistic musical performers: symbolic information is needed by mathematicians and linguists whileas semantic information would serve well to the speakers, teachers, scientists and planners. Lastly, those who deal with people can't do anything if they are lacking in behavioural abilities for example, police and judges, parents and teachers, politicians and statesmen.

## **Operations**

The second major principle is according to the kind of operations that are performed on the materials on which the operation is performed and the product is obtained. There are five recognized kinds of operations as cognition, memory, convergent thinking, divergent thinking and evaluation. All the five kinds of operations are applied to each of the four kinds of materials.

### **(i) Cognition**

It is the discovery and recognition of information. It is the basic kind of operation performed with information. Simply it means knowing, and technically it is a matter of structuring in one of the languages of information. The factors that are included in cognition are not only discovery abilities but they also pertain to re-discovering and recognition of elements and of things derived from them. We recognize figural objects, symbolic objects and meanings.

### **(ii) Memory**

Memory is the retention, recall and reproduction of information. Memory images are related to some past experience. When the image of an object comes to our mind and involves a reference to our past experience, we are said to remember the object. The experiencing of a perception in the past is only the first step or stage in the process of remembering. For example, taking tea with a friend was not merely experienced but was also kept or retained somewhere in the brain or mind till it was remembered. The fact of remembering also indicates that the impression was not merely retained but that it was capable of being reproduced or recalled to mind. Thus, memory is the next operation which is an important aspect of the intellect as no content without retention can be used at any later time. This is, in other words, the operation by which coded information can be put into storage and reproduced in terms of learned facts, formulae or other signs and symbols at the time of need.

**(iii) Divergent Thinking**

(ii) Divergent thinking is the process of thinking in different directions, sometimes seeking variety, from known and remembered information. It has been described as an ability to produce a large variety of responses. According to Guilford it is broad search or scanning of one's memory store. In brief, it is a generation of logical alternatives.

**(iv) Convergent Thinking**

Convergent thinking is a process of producing of correct or conventional answer from known and remembered information. It has been described as an ability to produce a well-determined answer. Guilford labels it as a focused search for the given information or problem involves specifications for one particular answer or solution. In brief, it is a search for logical imperatives.

**(v) Evaluation**

Evaluation is to determine how good, correct, or adequate is one's knowledge or thinking at a particular time. This ability is concerned with critical thinking. We check the information in order to see whether the information is just cognized or is produced divergently or convergently. In this operation, evaluations are made with respect to information, conclusions or other responses derived from given information. We may question our cognitions and things we recall as well as our solutions to problems and we arrive at decisions as to whether they are correct, suitable or adequate. Thus, we say that evaluation is the decision making process relative to the accuracy and appropriateness of the information that has been cognized. According to Guilford, it is probably safe to say that all our behaviour is checked and rechecked. There is comparison of output with input, according to cybernetic principles; comparison and decision as to suitability, agreement, logical consistency and other logical criteria and this all comes under the operation of evaluation.

## **Products**

The third major way of classifying intellectual abilities is based on the product involved. We come out with certain kinds of products by applying certain operations to certain kinds of materials. Products are of six categories — units, classes, relations, systems, transformations, and implications.

### **(i) Unit**

A unit is defined as a unit of thought, such as, figure, a symbolic structure or a concept. It can be a specific word or image. According to Guildord, a Unit has 'thing' character. The human body is comprised of different parts and each part is an Unit in itself. Thus, if the product in the form of an individual item or object, for example, one answer in terms of fluency represents one unit and as many answers are given, is the total of all units.

### **(ii) Class**

Classes are groupings of units of information according to common characteristics. We find similarities between units as they have characteristics in common. A class is comprised of many units and each unit is comparable to any other unit and can be grouped with any other unit having common characteristics. Example for a class may be cited as 'Parrot is a bird, 'the bird' is a class which includes not only parrot but also other birds such as, crow, sparrow, pigeon, etc.

### **(iii) Relation**

A relation refers to the relationship between units of information such as 'bigger than' or 'next to' and so on. It could be a relation of part to whole, as a finger is related to hand or elbow related to an arm. It could be a relation of opposition, as in the pairs of words, large and small. It could be a relation of class to member, in the pair animal and sheep. The relations are of two types positive and negative. When two objects or two ideas hail from the same source it indicates positive relation whereas if the sources differ it is termed as negative relation.



Relations can be reproduced in different ways, for example, relationship between a father and daughter. It could be said that they are related as parent and child, as being of opposite sex; or one is older than another; or one is stronger than another or wiser and so on.

#### **(iv) System**

A system is defined as a connection between more than two things based upon their interrelationships. It could be compared to units as the latter are based on their common attributes. When we compare it with the class, the latter is not organised with respect to units but in a system, the organization of units is the main condition. Examples of the systems are organised sentences, paragraphs, story plots, orders or sequences in time and in space or scientific theories and so on.

#### **(v) Transformation**

Transformation is defined as any change in pre-existing information. Any change in formation would become a new item of information such as redefinitions, inversions and re-arrangements. Transformation help in trying the new solutions instead of usual and familiar solutions for a given problem.

#### **(vi) Implication**

Implications refer to inferences drawn from current knowledge and applied to future actions. It is a broad kind of connection. When one unit suggests another, leads to another, or leads us to expect another, there is an implication, for example, the proposition is, if A, then B, which is logical implication. The other examples of implications are in the form of predictions and conclusions we make on the basis of current information (Guilford).

### **Relationship between Creativity and Intelligence**

The early studies stated above have attempted to trace the relationship between creativity and intelligence but as being highly suggestive could not point out the exact nature of relationship between

the two. Neither the factor analysis of Guilford alone would provide complete solution nor it could be determined by merely combining a few psychological tests of substantially differentiable psychological factors that seemed to be relevant on a priori definition of creativity and then showing that they correlate rather low with tests of intelligence. Many studies in the latter fifties and early sixties also adopted the same approach in order to demonstrate the distinction between creativity and intelligence. However, Wallach and Kogan (1965) have argued "the warrant for claiming an empirically separable divergent thinking domain depends—once the matter of face validity is taken care of upon showing that the divergent thinking tasks share a substantial amount of variance with convergent tasks than they share with one another; and that the measures of convergent thinking share a substantial amount of variance in common as well.

The second thing connected with the issue of relationship between creativity and intelligence is whether creativity is same in every field and whether there is only one type of creativity or many types of creativity needed in different fields. There is not only one field, there are different fields, such as, arts, music, sciences, mathematics, Engineering etc. Naturally, all the fields do not ask for one and the same creativity. Therefore, the final answer regarding the nature of creativity in a certain field will, perhaps, depend on the validation studies based on the use of external criteria. However, psychologists seem to have a consensus on this that some minimum level of intelligence would be needed in order to be creative whatever the field. This level might differ from one field to another. For example, the role of intelligence would be more prominent in scientific creativity than in artistic creativity. Similarly, in creative writing, a higher level of intelligence is more needed than for creative performance in music, dance and drama. Thus, Anderson's (1960) ability gradient' is worth mentioning here as it states that ability level can be thought of in terms of thresholds, meaning thereby that a minimum level of ability may be considered necessary to carry on a task, but beyond that level there would be other factors that would determine performance in that task. Getzels and Jackson have also found some correlation between IQ and Creativity scores upto a certain level of IQ but found no correlation beyond that point. Torrance (1962) in comparable studies confirmed the finding and also showed

that among the school population and with the types of tests he used, there was hardly any correlation between IQ and creativity scores beyond 120 IQ. Therefore, the minimum level of intelligence needed for a person to be creative is 120 IQ, beyond that both intelligence and creativity are independent of each other. Torrance estimates that we miss about 70 per cent of our more creative youth when we depend solely on IQ tests to measure ability. Razik (1967) points out that some types of creative talent may be found all along the 'normal' IQ range, even in children in the below-average group.

### **Relationship between the Two—An Issue of Measurement.**

The findings of Guilford led to an enthusiastic effort on the part of psychologists to search for suitable ways of measuring creative thinking abilities. The efforts were made that the tests be prepared in such a manner that they are able to define a dimension within the intellectual domain which is distinct from intelligence. It was necessary that the tests of creativity domain must therefore, correlate highly among themselves and should correlate so with intelligence.

The question here is whether there is an unified dimension of individual differences that warrants conceptualizing a general cognitive dimension of creativity that is like the concept of general intelligence but exists apart from the latter. To put this question another way we may ask whether the two concepts, namely, intelligence and creativity define dimensions of individual differences that vary independently of each other (Wallach and Kogan, 1965).

The most widely known research study in this area is that of Getzels and Jackson (1962). They took the sample of 192 boys and 241 girls ranging in class from 6th grade through the end of high school. Five creativity measures—word association, uses of things, hidden shapes, fables, and make-up problems; and a standard IQ test were administered on the sample. The results showed that all the five creativity tests correlated significantly with IQ for the boys whereas four of the five creativity tests correlated significantly with IQ in case of girls. Now, the important thing is to consider the relationship among the creativity tests—that is, the question of whether they define a unitary dimension of individual differences. The results showed that the five

creativity tasks are virtually no more strongly correlated among themselves than they are correlated with intelligence and that this is also true for both the sexes. The average correlations are 0.26 and 0.27 in the case of boys and girls respectively between creativity measures and intelligence and 0.28 and 0.32 for both boys and girls respectively among creativity measures themselves. In sum, the creativity measures correlated with intelligence on the order of 0.3 and also correlated with each other on the same very order. Thus, there is no strong evidence that would suggest that the creativity tests are any more strongly related to one another than they are related to general intelligence. In other words, it can't be said that creativity as a psychological dimension is distinct from intelligence as the tests of creativity share the same with one another what they share with intelligence.

The findings reported by Barron (1956); Torrance (1960); Guilford and Christensen (1956); Flescher (1963) and Torrance and Gowan (1963) have also arrived at the same conclusion. A recent study conducted by Cline, Richards and Needham (1963) on high school students have also shown the same results. The average correlations found for boys between the creativity tests and an IQ measure is 0.35 while it is 0.21 among the various creativity measures. The average correlations found in the case of girls between the creativity measures and IQ test is 0.33 while it is 0.24 among the seven creativity measures. Wallach and Kogan have reported that in reviewing the research in this area, the evidence led to the conclusion that the various creativity measures used are almost as strongly, equally strongly, or even more strongly related to general intelligence than they are related to each other. Hence, the conceptualization proposed by Getzels and Jackson that intelligence and creativity are two distinct dimensions within intellectual domain cannot be made in view of the evidence in hand.

The occurrence of such results are perhaps due to the inadequacy of the tasks involved in the tests of creativity, i.e. the fault lies in the measurement approach. Wallach and Kogan argues that a potpourri of abilities was being assessed in the good name of 'creativity'. They are of the view that creativity is essentially a thinking process which is distinguishable from other mental processes and suggest an associational concept of creativity consisting of two variables, namely, the total number of associations which a person is capable of making and

secondly, the relative uniqueness of his association process. They take Mednick's (1962) definition of creative thinking as "the forming of associative elements into new combinations which either meet specified requirements or are in some way useful." Wallach and Kogan, thus, devised procedures which emphasized the person's ability to generate a large number of ideas in response to a given task, and mainly those ideas that could be considered as unique. They emphasized two additional features to be included in the tests of creativity, i.e. freedom from time pressure and a game-like context rather than an examination or test-setting. They administered ten creativity measures and ten intelligence measures on 70 boys and 81 girls. The creativity measures were based on the associational concept and game — like context. The results showed that the ten creativity measures proved to be highly intercorrelated, the ten intelligence measures also proved to be highly intercorrelated and the correlation between the creativity measures and the intelligence measures proved to be extremely low for the whole sample as well as separately for boys and girls. The average correlation among the ten creativity measures is on the order of 0.4; the average correlation among the ten intelligence measures is on the order of 0.5 whereas the average correlation between creativity and intelligence measures is about 0.1. Thus, they have been able to demonstrate creativity as a psychological dimension within the intellectual domain which is distinct from general intelligence. Wallach (1970) concluded that independence from conventional intelligence tests is obtained when the creativity test emphasize ideational fluency, whereas high correlations with intelligence tests result when emphasis is on verbal facility or vocabulary size. They then suggested that this conclusion reemphasizes the need for creativity tests to be administered without time limits, since time limits necessarily limit ideational fluency by cutting off the flow of ideas and hence also restrict creativity. Wallach and Kogan's emphasis on ideational fluency as the key element of creativity tests is highly consistent with Guilford's original descriptions of the mental abilities involved in divergent thinking. Copley and Maslany (1968) extended the Wallach and Kogan findings to some extent, by showing that a similar pattern of inter-correlations persisted even when the tests were administered to High School and University students, both in a group setting and with self-recording of responses.

**Present Position**

The results obtained from the above studies support the hypothesis that the correlations between creativity and intelligence are so low as to warrant conceptualizing a general cognitive dimension of creativity as different from intelligence. Different researchers went on delving deep to find out further empirical evidence with respect to the nature of relationship between creativity and intelligence. Some researchers have shown low correlations; some have indicated zero correlation whileas some have shown high correlation between the measures of creativity and intelligence.

**Low Correlation (Non-Significant Relationship)**

Beaudot reports low correlation between creativity and intelligence while administering a translated version of the Torrance Tests of creative thinking on 156 boys and girls, of the age group of 11 years in Paris. To find out the IQ score he administered a test of general intelligence. The results indicate no significant correlations (0.04) between creativity and intelligence measures. Nijesse in Holland have also reported somewhat similar results by correlating creativity measures with intelligence measures. He used to creativity measures (verbal and figural) of Wallach and Kogan and one numerical test of Guilford to measure creativity. Intelligence was measured by standard intelligence tests. One more thing was added while administering the creativity measures on the sample of 192 boys and 211 girls, i.e. with time limits and without a time limit. Wallach and Kogan have used without a time limit). This average correlations between the creativity measures and measures of intelligence were found ranging from 0.05 to 0.17. The low correlation with intelligence measures makes clear that some creativity tests measure an ability which is not covered by intelligence. It is through the factor analysis technique, Nijesse pointed out that the first factor was clearly interpretable as creativity and the second one as intelligence. With regard to the difference between testing, with and without a time-limit, it was found that the latter condition, for boys as well as for girls, led to significantly higher scores than the former condition. Zetenyi (1977) while giving a brief review of the researches done in Hungary on the relationship between intelligence

and creativity reports that the intelligence measured by different tests and creativity assessed by the creativity tests invariably show a low, mostly positive and non-significant correlation with each other in essentially different age groups, at extremely variant levels of education as indicated by the researchers like Albert, 1971; Barkoczi, 1973, 1976; Barkoczi and Pleh, 1972; Barkoczi, Olah, and Zetenyi, 1973, 1975; Bolla, 1976; Kasa, 1974; Klein, 1970, 1972, 1973, 1974, 1975; Klein and Zetenyi, 1974 in their studies.

Reid (1970) in a significant piece of research undertook a factorial study of creativity of 87 boys and 79 girls at intermediate school. The intelligence tests used correlated highly among themselves whereas the creativity measures revealed moderate interrelationships (around 30). Scoring dimension inter-correlates across tests of creative thinking were extremely low. Thus, the low inter-correlation between the intelligence and creativity measures strongly suggested different aspects of cognitive functioning, were being tapped.

### **No Correlation (No Relationship)**

Some studies have been reported in the literature that show that it is not simply true that the more intelligent person is necessarily the more creative one. Mackinnon (1963) after conducting a series of studies on the relationship between creativity and intelligence reports that "with the exception of mathematicians among whom there is a low positive correlation between intelligence (as measured by the Terman Concept Mastery Test, 1956) and the level of their creativeness, they have found in their creative groups studied in their institute essentially no relationship between intelligence so measured and creativity". In another study, they took a sample of forty creative architects, who obtained the mean score of 113 on the concept Mastery Test with individual scores ranging from 39 to 179 correlate with their creativity (-0.08) as rated by architectural experts. In another study of 28 professors of architecture whose Terman scores ranged from 36 to 170, intelligence so measured correlated (-0.07) with their judged creativity and in a still later investigation of 21 graduating seniors in architecture whose Terman scores ranged from 17 to 142, the correlation of intelligence so measured and judged creative potential for architecture, though

positive, was low and not significant (+.14). In the light of the results, Mackinnon believes that above a certain required minimum level of measured intelligence which varies from field to field and in some instances may be surprisingly low, being more intelligent does not guarantee a corresponding increase in creativeness. The results from a number of studies (Getzels and Jackson, 1962; Wallach and Kogan, 1965) also indicate that although persons above average in intelligence are more likely to be creative, it does not mean that average or highly intelligent persons are necessarily creative. Torrance (1962) states, "if we were to identify children as gifted simply on the basis of intelligence tests, we would eliminate from consideration approximately seventy per cent of the most creative. An interesting piece of research has been conducted by Kogan and Pankove (1972) in which they studied 16 males and 13 females students at 5th grade and 10th grade (after five years). In fifth grade, their creativity and intelligence did not show any correlation but at the tenth grade, there were significant positive correlations between creativity and intelligence in the case of boys and no relationship between creativity and intelligence did exist in the case of girls.

### **Indian Scene**

In India, too, various researchers have attempted to seek the relationship between creativity and intelligence. The results based in their researches vary from showing high correlation to no correlation between the two. Fatima and Mehdi (1971) working with 8th graders on a set of three non-verbal creativity tasks (which form part of a battery of creativity tests developed by Mehdi, 1973) found that the correlations between creativity and intelligence were very low ranging from -.179 to .125, the correlation among the creativity tasks themselves except for the originality were significant at .05 level. In two other studies based on two different samples (urban and rural), Gupta and Mehdi (1972); and Aziz and Mehdi (1973) also obtained the similar results. Mehdi (1977) in another study, on a sample of 1054 boys and 337 girls drawn from the states of Uttar Pradesh and Madhya Pradesh studying in VII and VIII grades found that the correlation between creativity and intelligence was significant but considerably low. Gutpa (1980) reported that creativity whether verbal or non-verbal was independent



of intelligence. The similar result has been reported by Brar (1987) in seeking the relationship between the measures of creativity and intelligence. On the other hand, Dharmangadan (1976) reports positive and significant relationship between intelligence and creativity. The similar results were obtained by Quareshi (1980) and Dey (1984) while studying the relationship between the two. Menon (1980) reports positive but low relationship between the measures of intelligence and creativity. Muddu (1980) reports negative relationship between creativity and intelligence. Trimurthy (1987) reports that the students with high I.Q. were found more creative than students with low IQ in verbal creative thinking and in the case of non-verbal creative thinking, IQ did not exert any significant influence. In a recent study Chadha and Chandha (1990) have indicated positive and significant correlation between the measures of creativity and intelligence when the effect of scholastic achievement is partialled out.

The nature and extent of relationship between the creative and intelligence thus suggests two things. First, whether the tasks used in the tests measure what they are expected to measure. Therefore, much depends on the type of tests used. Second, the nature of the sample to be studied determines the size of the relationship between the two.

## 5

# Creativity And Achievement

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There has been a controversial debate on the relationship between creativity and achievement in school and later vocational success. Some researchers have attempted to trace the relationship between the two in view of the divergent thinking and convergent thinking. In their view, the creative thinking abilities are apparently as important as those measured by traditional measures of IQ in educational achievement. They emphasize that divergent thinking and convergent thinking do not operate separately; they interact in achievement. In the opinion of others, creativity facilitates achievement by building on to convergent thinking and that a minimum level of IQ is necessary for high levels of achievement.

Getzels and Jackson (1962) focussed attention on the relationship between creativity and achievement and they selected two groups of children as 'High IQ' and 'High creative'. The first group comprised of children in the top 20 percent on IQ but not on creativity, while the second group consisted of children in the top 20 per cent on creativity but not on IQ. Though the intelligent group had a mean IQ 23 points above that of the creativity group, no significant differences were detected between the two groups. The findings of Getzels and Jackson that the creative thinking abilities are apparently as important as those measured by traditional measures of IQ in educational achievement seem to be misleading and most probably the result of the procedure used by them in sampling of children. That the sample of children studied by them was a particularly unrepresentative one, for example the mean IQ for the whole student enrolment of 449 was 132, while the high creative group which was selected in such a way as to exclude students of really high IQ, nevertheless had a mean IQ of 127.

Consequently, various researchers have tried to verify the relationship suggested by these two authors. Torrance (1960) has conducted, at least, eight replicatory studies in which he avoided some of the shortcomings of Getzels and Jackson. In four of the six studies conducted on elementary school children he found that there were no significant differences in overall academic achievement between the 'High IQ Group' and 'High Creative group'. Also he arrived at the same results in case of both samples of university students which he studied.

Flescher (1963) has also tried to clarify the relationship between creativity and achievement in study in which the validity of implications concerning the comparative influence of unusual creative thinking and exceptional intelligence in the learning process has thoroughly been studied. He designed this study in the manner involving the two groups left out by Getzels and Jackson and Torrance in their studies; one characterized by non- extraordinary intelligence and creativity, and the other by High creativity and high intelligence. He found that there existed a significant relationship between intelligence and scholastic performance while creativity was not related to academic success.

Mehdi (1977) points out that to speak of high correlation between creativity and school achievement of the formalized kind is in itself a negation of what we know about the relationship between creativity and intelligence. That Getzels and Jackson and also Torrance did find a substantial relationship can be easily explained by the fact that they were concerned with those pupils in the creativity group, who possessed sufficiently high intelligence, considerably above 120 IQ. Once the intelligence of high creatives fell below this level, the mean achievement scores of the "High creative Group" fell significantly below those of the "High IQ Group".

Some researchers have however found a positive and significant relationship between creativity and achievement. In an attempt, Yamamoto (1964a) compared the academic performance of secondary school children on the design used by Getzels and Jackson. The results he obtained were interpreted by him as "clear cut". Despite IQ differences of 20 points, the divergent thinking group did as well on the Iowa Tests of Educational Development as did the high-IQ group. The

same results were found for both the sexes combinedly and separately as well. In another study, Yamamoto has revealed that there existed significant differences between high creatives and low-creatives in their school achievement. In this study, Yamamoto (1964 b) compared the achievement scores, of the 'High Creative Group' with the 'Low creative group' allowing for differences in IQ between the two groups. The results he obtained showed that the highly creative thinkers surpassed the low- creative children; and the differences in achievement between the two groups were not due to differences in their IQ. Thus, he arrived at the conclusion that there exists a significant relationship between performance on creativity tests and success in school learning.

Cropey (1970) has also attempted to investigate the relationship between creativity and school achievement of children. In designing his study, he involved four groups of children instead of two, namely, 'High-High Group' consisted of children in the top half on both creativity, and IQ measures; the second group "Low-Low Group" comprised children in the lower half on creativity and IQ; the third group "High-low Group" contained children high on IQ and low on creativity and the fourth group "Low-High Group" involved children low on IQ but high on creativity. He showed that the mean achievement scores formed an ordered sequence in descending order, with the High-Highs averaging 69.6 per cent and the Low-Lows 51.9 per cent. His results, thus, revealed that the children of the "High-High Group" surpassed all other groups in their achievement which suggests that IQ alone is an inadequate predictor of academic success; at the very least, high achievement as well as low achievement scores can be affected by the creativity scores. In a recent study conducted by Dey (1984) on National Rural Talent scholarship Awardees has also demonstrated the positive and significant relationship between creativity and the total subsequent achievement scores of NRTS awardees.

One point that seems worthwhile in considering the relationship between creativity and achievement is the nature of the tasks involved in the creativity tests used and also the nature of the achievement taken as the criterion. Insofar as the creativity tests are concerned we shall have to see whether they are able to measure those thinking abilities that are distinct from those that are measured by the intelligence tests. For the achievement too, we shall have to see what type of achievement

criterion has been used. If the achievement emphasises convergent-type of learning and is measured by convergent type of tests, then one should not expect any sizable correlation between creativity and achievement. Likely, a measure of divergent thinking should not be expected to correlate highly with convergent-type of achievement. Next, the mental abilities sampled by various tests of the convergent type are of differing importance in different types of achievement. For example, a verbal IQ test is expected to be more useful in predicting success in verbal tasks than in performance tasks, and so on. Similarly, it seems likely that the skills sampled by divergent tests may be more important in some kinds of school achievement than in others.

Torrance (1962) has discussed this point in some detail in the light of the results he has obtained from the studies conducted in five U.S. elementary schools. He has compared the mean achievement scores of "High IQ" and "High creative" groups of school children in four subject areas. His results reveal that highly creative children tend to do better in reading and language skills, despite IQ differences which were as large, in some cases as 26. In the case of university students, the highly creative students tended to surpass the high IQ groups on measures like creative applications and self-initiated learning, again despite large differences in intelligence in favour of the "high IQ groups".

Some correlational studies also provide the evidence that high levels of creativity are differently related to success in different subject areas. For example, Torrance (1962a) reports partial correlations (with the effect of IQ removed) of .48 between creativity and reading skill, and only .28 between creativity and arithmetic skill, Cline, Richards, and Needham (1963) have also demonstrated that scores on creativity tests correlated significantly with high school science marks. The results, thus available support the hypothesis that it is the nature of tests whether divergent or convergent that determine the total achievement and also in different subject areas, for example, in Arithmetic tests emphasis is more on convergent type tasks whereas language tests emphasize divergent type tasks.

Hudson (1966) approached the issue of relationship between creativity and academic achievement in a different way. In a series of

studies covering several years and involving several hundred boys of proven academic ability, he investigated relationship between academic achievement and intellectual style. He was interested in the extent to which the stylistic biases in the boys' profiles on a number of ability measures, including IQ, accuracy, vocabulary, general knowledge and expressed interests, were reflected in their preference for arts or science-type subjects. He observed that it was possible, to sort the boys into 'arts-bias' and science bias' groups, by examining their score patterns. He arrived at the conclusion that success in a particular subject area is closely related to an individual's intellectual style. Elaborating on this point he suggested that divergent/convergent thinking dichotomy is one major way of conceptualizing differences in intellectual style; that the divergent thinkers show an overwhelming performance for arts subjects whileas convergent thinkers strongly give their preference for science subjects. Thus, Hudson's research adds strong support to the idea that preference for a divergent mode of thinking is reflected in a particular pattern of school achievement.

Despite contradictory views on the relationship between creativity and academic achievement there is a large consensus on the positive role of creativity in facilitating achievement. There are differing view points as suggested by different researchers in which creativity may facilitate academic achievement. Bruner (1962) has suggested the conventional intelligence as the basis for creativity. In his view, convergent thinking provides an essential foundation on which the divergent thinker builds. The creative solutions occur only when the relevant field of subject matter is thoroughly known. In support of his argument Bruner (1963) points out that the major kind of intellectual behaviour consists in reorganising data input from the external world, in such a manner so as to reduce the cognitive strain of information processing. The data reorganisation, according to him results in the coding of data, i.e., grouping of data into different categories or combinations. Thus, the combinations the conder produces are creative; they are not random, nor are they blind stabs they are actually the effective insights based on his previous knowledge and are associated with the elements of effectiveness and surprise. In this way, Bruner has pointed out as to how a divergent thinker builds on covergent thinking (intelligence) and also the importance of intelligence in creative

solutions without which the latter is impossible to occur.

Pribram (1964) has also supported the view point suggested by Bruner that the conventional intelligence is the essential basis for creative endeavours. For him the original productions do not arise by chance rather they are an extension of the already known. He emphasises strongly that the creativity arises out of conventional intelligence i.e. the work involved in divergent thinking is concerned with extending the boundaries of the conventional, and in widening existing structures. In his view, it is essential that for creative thinking, the boundaries of the known are mastered thoroughly first through convergent processes and then, extended by the application of divergent processes.

The second view point that the minimum level of intelligence is necessary for high levels of achievement, is, too, related to the first view-point that creativity interacts with intelligence in adding to achievement by building on the convergent processes is actually based on the notion that there may be an IQ threshold below which divergent processes cannot operate, and above which they become independent. It is McClelland (1958) who first introduced the threshold concept in hypothesizing the relationship between IQ and achievement. In his observation, IQ and achievement are closely related only upto a certain level and beyond that level, achievement no longer is directly related to IQ but is determined by other factors.

Anderson's (1960) concept of ability gradient seems to be the extension of threshold notion to the divergent thinking, according to which ability level can be thought of in terms of thresholds, meaning thereby that a minimum IQ level may be considered necessary to carry on a task, but beyond that level there are other factors that would determine performance in that task. Likely in achievement, too, the minimal IQ level is necessary but beyond that level creative functioning does not depend on merely IQ but other factors like personality. Thus, according to the threshold concept, divergent processes begin to function powerfully only when convergent processes had been sufficiently developed to permit appropriate mastery of the particular fields.

On the basis of substantial empirical evidence, Torrance (1962) has suggested about 120 as the IQ level (threshold) beyond which

creative thinking bears a relationship to classroom performance which is independent of IQ 'Yamamoto (1964) further tried to clarify this view point and selected the top 20 per cent of students in a secondary school on creativity and then further divided this group into three IQ groups, such as, group I contained students with IQ's above 135 group II consisted of students whose IQ range was between 120 and 135; and the group III comprised students with IQs less than 120. After comparing the achievement scores obtained on a number of achievement measures, he could find a marked evidence for a threshold effect as the two groups with IQ greater than 120 achieved much the same scores on the various achievement measures, though the middle IQ group sometimes surpassing the high IQ group, but the low IQ group (IQ less than 120) was surpassed by both groups on each achievement measure. Thus the findings of Yamamoto that the high IQ group (135) could not surpass the middle IQ group (120-135) and the low IQ group (less than 120) was surpassed by both groups on each achievement measure. Lent support to the view point that though a minimum level of IQ (120) is necessary for high levels of achievement, and beyond that level hardly achievement is affected by the increase in IQ but that beyond the same very level (120 IQ), highly creative thinking adds significantly to scholastic achievement.

The two view point discussed, thus, suggest that divergent thinking and convergent thinking interact in achievement. They are, in fact, not independent intellectual modes which operate separately from each other, but interdependent facets of intellect, although the degree of inter-dependence decreases as IQ increases, and may reach at zero at very high IQ levels.



## 6

# Creativity and Personality

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It has been generally agreed that creativity is the most valued human quality. It is considered vital for shaping the man's future. Hardly there may be anyone to overlook the importance of creativity. But it is not enough to recognize its importance, the more important is that how we can gather knowledge on scientific principles and thus the knowledge accumulated is used to help man in the development of his creative potential.

Researchers generally agree that all people are, to some degree, potentially creative, no matter what their ages are; which culture they belong to, or which occupations they hold. Second, individuals differ in their degree of creative potential in various fields of activity, and in the modes of expression of their creativeness. Rewiewing American research Taylor (1975) observed that a great deal of research has focussed on identifying the characteristics of a creative person usually from a trait point of view. For researchers like Hudson (1966), the roots of creativity do not seem to lie in convergent or divergent thinking, they lie in the personality and motivational aspects of character. Therefore, it is worthwhile to know about the personality characteristics that go with a creative person. Different theorists have put forward their view points regarding a creative person. So far as the intellect theory is concerned it lays emphasis on the cognitive aspects of personality while as trait theory identifies a number of traits which make an individual a creative one's whichever the theory, it has long been agreed upon that personality factors are important in creative achievement. Not only that but personality factors are also important even in the matter of identification of creative talent. Hargreaves (1927) reported that the 'unknown' common factor found in his measures of imagination is

conative in nature. Guilford, Frick and Merrifield (1957) have also reported a large number of correlations between the non-aptituded traits and the measures of originality and ideational fluency. Non- aptitude traits include impulsiveness, self-confidence, ascendance inclination away from neuroticism, aesthetic expression, tolerance in ambiguity, and disorderliness.

Since the manifestation of creativity takes place at younger age, it is worthwhile to study personality characteristics of creative at all age levels. An attempt is made to review the creativity research in order to gather knowledge regarding the creative growth at infancy, childhood, and adolescence stages.

### **Creative Child**

Every creative person passes through different stages such as infancy, childhood and adolescence. Each stage has its own characteristics, therefore, it would not be worthwhile to study the children of one age-group and infer generalisations for children of all the age-groups. Second, adolescent age is a crucial one as new creations and productions oftenly take place at this stage. While commenting on the childhood age, Cole (1940) points out that Newton's childhood years are marked by making water clocks and Windmill models; James Hillier constructed his first microscope during his boyhood years; Pascal wrote his essay at the age of 16 years; Samuel colt also started working on his idea of the revolver at the age of 16 years and George washington developed a device for replacing derailed cars when he was about 19 years old. The infant age period is no less crucial as the researchers report a decline in imagination at about this very time. Empirical evidence reveals that only a few studies have been conducted on infants, not particularly, with regard to investigating the personality characteristics associated with creative children rather to understand the imaginative powers of children. Though there is not a sizeable number of researches done in this area yet a few studies that have been conducted throw some light on the personality characteristics of creative children.

Ribot is understood to be the first who in one of his early investigations in 1906 used the term, imagination and revealed the

growth and rivalry of imagination and reason through the period of childhood and youth. MC-Millan (1924) has identified three stages in the development of imagination. During the first stage, the young child has a sense of beauty which serves for him as a short-cut to knowledge. He comes to grips with the realities during the second stage, and in the third stage he begins to work out the ideal of his first vision of the world by small degrees. While observing children's imitations, transformation of objects, dramatization, imagery playmates, fancies, new games, new uses of stories, aesthetic appreciation, Andrews (1930) reported that infants have imaginative powers. While working with children Grippen (1933) observed that the Children in the age-group 3-7 years have capacities to form various images, organise them and reassemble them to improve the theme which exhibits their aesthetic sense and emotionality. Markey (1935) has depicted the growth and decline in imagination in infants. He found that imaginative power increased in infants with increase in age throughout the preschool period, however, the performance on the housekeeping game and fanciful naming of visual stimuli decreased in the older children. Ligon (1957) has beautifully depicted the growth-trends in imagination in children at various age levels. According to him, the children begin to develop imagination through direct experience and repetition of their experiences in verbal and imaginative play at 2 to 4 years' age. At the age of 4-6 years, the child learns the skills of planning for the first time. He is learning adult roles through pretended play. He experiments with many roles in his imaginative play. The creative imagination of the child between 6-8 years takes a turn towards realism to the extent that he tries to reproduce details even in play and uses his imagination to personify moral principles. Between 8-10 years he is increasingly able to use a variety of skills creatively and discovers ways for using his mind in a creative manner, children get pleasure in taking keen interest in exploring new and new things during the period 10-12 years. While commenting on the imaginative powers of creative children Colvin (1902) observed that such powers are actually observable in these children at early school age and they carry these powers with them through high school age and at the college and university levels they receive specialized education and become capable of creating some creative productions in the shape of books, monographs and articles. A good picture of the creative child as compared with the highly

intelligent emerges out of a study by Getzels and Jackson (1958). In their attempt to identify the significant variables which differentiate the highly creative child from the highly intelligent child, Getzels and Jackson (1958) studied the achievement motives, school performance, fantasy production, and reported that the creative group rated higher than the highly intelligent group on interests, emotional stability, and humour while as they rated lower on I.Q., marks, character and goal-directedness than the highly intelligent group. The highly intelligent group wished to have such qualities which would lead them to success while as the creative group did not express such ambitions. The creative group showed a keenness towards unconventional jobs than highly intelligent group. Reid, King and Wickwire (1959), have found creative children as more sociable, more warm-hearted, more emotionally stable, more confident more self sufficient and less anxious. While comparing them with non-creatives, Weishberg and Springer (1961) have also attempted to portray the picture of highly creative child. They have found following personality characteristics associated with a creative child:

- (i) having strong self image;
- (ii) can easily recall earlier experiences even though they have been unpleasant;
- (iii) humorous;
- (iv) accepts himself creatively and possesses greater self-awareness;
- (v) exhibiting greater independence from the environmental influences and readiness to respond to them; and
- (iv) Showing less conformity to parental values.

In his personality studies of highly creative children, Torrance (1962) found that at least three personality characteristics stand out that differentiate the highly creative children from the less creative and these are:

- (i) The highly creative children have reputation for having wild and silly ideas especially the boys;
- (ii) Their work is characterized by the production of ideas "off

the beaten track'' outside the mould;

- (iii) Their work is characterized by humour, play-fulness, relative lack of rigidity and relaxation.

In India too the researchers have also attempted to find out the personality characteristics of creative children. Goyal (1969) on the basis of his investigation on 8th graders reported that the creative children possessed a higher level of energy. They rejected suppression for the control of impulses. They were found more introverts and more independent in thought and action. They have the capacity to tolerate ambiguity and opposing values. While comparing the highly creative and highly intelligent groups of children Babu (1977) found them discriminating significantly on personality variables such as, self-reliance, withdrawing tendencies, nervous symptoms, social standard, antisocial tendencies, family relations, school relations, and anxiety. Verma (1973) reported that creative children are more autonomous, non-conformists, and have openness of mind. Muddu (1980) has beautifully attempted to present the picture of a highly creative child as:

- (i) more controlled;
- (ii) strives to get acceptance or a approval;
- (iii) more ethical;
- (iv) more ambitious;
- (v) more concerned with social images;
- (vi) considerate to others; and
- (vii) far-sighted, conscientious, relaxed, unfrustrated, and composed.

Pachauri and Pahdi (1988) report the creative child as perceived by the elementary and secondary school teachers of Oriya as timid, disturbs class organization, stubborn, fearful, critical of others and fault finding, however, they point out that the two creative traits like curious and independent in thinking as supported by the Oriya teachers both elementary as well as secondary collaborate with the findings of USA educators, Berlin elementary and secondary school teachers (Torrance,

1965), the elementary and secondary school teachers of Germany (Torrance, 1965), the science teachers of the U.K (Wilkinson, 1972) and India (Raina, 1969; Pachaury, 1985).

### **Creative Adult**

In view of the influence of each stage of age mostly researchers in India and abroad have attempted to study the personality characteristics of creative persons. What are the most significant characteristics that go with a creative person? This question has been answered differently by different researchers. Lownfeld (1952) has demonstrated atleast eight characteristics which are most dominating among creative persons such as, sensitivity to problems, fluency, flexibility, originality, redefinition, ability to abstract, ability to synthesize; and coherence of organisation. The same characteristics were also found by Guilford in his studies conducted in 1954, 1956, and 1957. Runner (1954) lists the following characteristics of a creative adult:

- (i) seeks change and adventure. Any system he follows will be his own system;
- (ii) is inclined to sloppiness and disorganisation. He may give meticulous attention to things which are important to his self;
- (iii) has no tendency to plan activities and changes them quickly, waits for developments, doesn't expect to be able to predict in detail and probably does not try;
- (iv) questions rules and authority;
- (v) is inclined to be close with strangers but does not stick to any particular group and may talk too much or refuse to talk at all if he is interested in something else; (vi) is tolerant and open minded hence thinks of people as individuals and believes in goodness of people;
- (vii) regards conformity with disdain; and
- (viii) disciplines himself to accomplishments of specific results but acts impulsively and does not stick to any one course of action.

Barron (1955) however has demonstrated some what different characteristics of a creative adult as; he is more complex psychoynamically and has great personal scope; is more independent in his judgements; is more self-assertive and dominant; and rejects suppression for controlling impulse.

Eric From; Rogers, and Maslow have also attempted to investigate the personality traits that are associated with creative persons. From (1959) observed atleast four significant personality traits in creative persons and these are : (i) capacity to be puzzled; (ii) ability to concentrate;

(iii) capacity to tolerate conflict; and inclination to get rebirth everyday. While discussing the personality development of creatives. Rogers (1959) views that openness to experience, internal locus of evaluation, and ability to toy with elements are the most important traits of a creative personality. In self- actualization theory, Maslow (1962) observes that the creative people are spontaneous, expressive, innocent, unfrightened by the unknown or ambiguity, accept uncertainty, able to integrate opposities, and are self actualizing. He depicts the personality of a creative person as "not neglecting the unknown, or deny it or run away from it, or try to make believe that it is really known, nor does he organise, dichotomize, or rubricize it prematurely. He does not cling to the familiar, nor is his quest for the truth a catastrophic need for certainty, safety, definiteness, or order rather he can be, if the total objective situation calls for ti, comfortable disorderly, sloppy, anarchic, chaotic, vague, doubtful, uncertain indefintie, approximate, inexact, or inaccurate. (Maslow, 1954)

Palm (1959) in his study of highly creative people found them having stronger needs on deference, exhibition, succorance, abasement and change. Mackinnon (1960) has beautifully portrayed the picture of a creative person as having such self image that he should be respected; (ii) having a sense of destiny aboutself; (iii) having openness to experiences; (iv) struggles towards reconciliation of opposites; (v) strives for creative solutions to even more difficult problems; and (vi) is having high orientation to aesthetic and theoretical interests and values.

Torrance (1962) after surveying a large number of the studies has enlisted atleast 84 characteristics in his book "Guiding Creative Talent"

that are associated with a creative person. The most significant among them are; adventurous; always baffled by something; attracted to disorder; attempts difficult jobs, constructive in criticism, courageous; conscientious; desires to excel, determination; discontented; destrubs organization; dominant; emotionally sensitive; energetic; does not fear being thought different; curious, likes solitude; independent in thinking and judgement; individualistic; intuitive; never bored; non-conformist; not popular; gets pre- occupied with a problem; persistent; questioning; receptive to external stimuli; rejects suppression and repression; reserved; resolute; self starter; self-confident; self-assertive; humorous; sensitive to beauty; sincere; stubborn; some what uncultured; visionary; versatile and willing to take risks. Taylor (1962) has also given a picture of the creative individual as unconventional and resisting the drives towards conformity and conventional thinking.

Taher and Rzik (1966) are of the opinion that research in creativity is yet at an early stage and no single characteristic can amount for the total creativity process. The authors have, however, indicated that research findings in general have provided a working model of creative person as possessing the following characteristics; (i) Originality; (ii) independence of judgement; (iii) sense of humour; (iv) curisoity; (v) sensitivity to problems; (vi) strong liking for autonomy; (vii) Goal orientation; (viii) capacity to concentrate on the task; (ix) flexibility; (x) sponaneity in disposition; and (x) willingness to take risks. Getzels (1969) in his personality studies has observed the creative person as having the characteristics such as; open mindedness, tolerance, insight, originality, independence, skepticism, fluency, self-sufficiency, maturity, determination, industriousness, enthusiasm, self-confidence and a sense of humour.

Taft, Dewing and Gilchrist (2970) carried out a series of personality studies of highly creative persons. In one study they studied both highly creactive and highly productive people and report that these persons have the traits of rapidly changing states of consciousness, intense emotionality, and interest in movelty. The highly creative persons had traits associated with self-actualization. Taft (1970) in another study found highly creative persons as more inventive, unconventional and neurotic than the less creative persons. Females were found to be more ego-permissive than the males. Yet in an another



attempt in 1970, he found the creatives as permissive expressive and controlled-coping. Curlier (1980) studied the relationship between flexibility and personality factors. According to her, a significant relationship exists between flexibility and personality factors. Thus, in her opinion creatives are tolerant of complexity and are independent.

Discussing the creative production, Guilford (1980) has emphasized that it is not alone the intellectual abilities which go in producing any creative output, personal and motivational traits are equally important. He says what is true of the multivariate nature of intellectual abilities is also true of non-intellectual qualities. Each person may have some characteristics which are favourable to creative output. His stronger motivational traits such as needs, interests and attitudes determine to some extent his source of satisfaction while as his temperamental traits determine his strategies and how his talents will be used. The most important characteristics of the more creative person, thus, according to Guilford are : (i) is having an unusually strong curiosity; asking question and not getting satisfied with the surface appearance of things; (ii) is having an interest in reflective thinking; (iii) is less tied to reality which suggests more readiness to let transformations occur or even to seek them;

(iv) is having unusual appreciation of humour;

(v) is impulsive and willing to take risks;

(vi) is having a high level of tolerance of ambiguity;

(vii) is self-starting with a strong need for autonomy and self-direction;

(viii) is having preference for unusual careers;

(ix) possesses independent judgement;

(x) is having high level of self-sufficiency and low level of sociability;

(xi) is self-assertive; and

(xii) is having more aesthetic interests;

In India, the research on creative personality is in no way of less concern to its researchers. Bali (1981) has studied the personality

characteristics of creative persons in different fields. He reported poets as having emotional sensitivity, creative mood and social will; painters also possessed emotional sensitivity and creative mood whileas scientists were found having ago ideal, emotional introversion and social will. Other researchers having studied the personality characteristics such as; anxiety (Raina, 2968).

Conformity and non-conformity (East, 1969); introversion-extroversion (Paramesh, 1970); achievement motivation (Jawa, 1971; Kumar and Raina, 1976); Level of aspiration (Bhan, 1973); temperament (Paramesh and Narayanan, 1976); self-sufficiency (Passi, Sansanwal and Jarial, 1981).

The personality characteristics depicted by the above said researchers are quite different from one another, therefore, it does not warrant to formulate generalizations. Most of the studies are quite limited in their scope as far as the population they have studied, the controls they have employed, and the techniques of measurement they have used. Mackinnon has aptly remarked that "there are many patterns along which persons travel towards the full development and expression of their creative potential and that there is no single mould into which all who are creative will fit. The full and complete picture of the creative person will require many images". But still then there seems a general agreement among researchers on certain characteristics that generally characterize the creative person which are discussed briefly as under :

The creative person shows his inclination towards vague and ambiguous ideas whileas others ignore them.

The creative person has always been observed as exhibiting his interest in vague and ambiguous ideas whereas such ideas do not normally attract others. This characteristic is very important in seeing problems. The creative person does no get satisfied with the surface appearance of things. He wants to go to the bottom of his experiences. Therefore, it is the first experience that the creative person experiences that he gets aware of the problem and getting aware of the problem is the starting point which provides him leads to creative production.

### **The Creative Person Believes in Independent Judgement.**

The creative person has the capacity to take independent decisions. He does not look for others to take a decision. In other words, we can say that the creative person is a self-starter as he has the strong need for autonomy and self-direction. He prefers unusual careers and avoids the conventional ones. Nothing like prejudice comes in his way when he takes decisions. He expresses his ideas fully and never attempts at suppressing them. No doubt, he feels the need for recognition from others for his production but always he has his own standards for evaluation and that is why he is said to be possessing independent judgement.

### **The Creative Person is said to be Curious**

Curiosity is an important characteristic of a creative person. He is always anxious to understand all the peculiarities of the world. He is interested in observing each and every object through piercing eye. He does not get satisfied with the surface appearance of things. He goes to the bottom of each and every object. He is explorer by nature. He goes on exploring and investigating throughout until he gets satisfied. This very search for satisfaction leads him to produce something new and novel.

### **The Creative Person Prefers Complexity more than Simplicity**

The personality of a creative person is dominated more by the element of complexity than simplicity. He is easily attracted by the complex objects or task. This very need helps him in seeing a problem. He goes on searching for the solution of the emerging problem and one time gets thrilled when solution is reached. Secondly, he gets attracted towards incomplete things. He has the courage to tolerate confusion while dealing with complex objects. No matter what the circumstances are or what people may say he has the courage to test his ideas and give them a practical shape.

### **The Creative Person is more Imaginative**

The creative person is said to be more imaginative. He is less tied

to reality which suggests more readiness to let transformations occur, or even to seek them. He is unwilling to accept things as they are; he seeks to improve them by bringing his imagination into play. He constantly goes on thinking that there must be a better way. He always makes an effort to attempt even difficult tasks which others usually avoid because of confusion and harm. Secondly, he has enough of far-sightedness which helps him to make quesses for the future shape of things to come.

### **The Creative Person is said to be adventurous**

According to Guilford, for each divergent production ability there is a need for adventure. This may account for the more creative person's willingness to take risks. The creative person is said to be taking risks without caring for the consequences as he is having high level of tolerance of ambiguity. He likes disorder perhaps as a challenge for producing order.

According to Erich Fromm, a creative person is always willing to be born every day. To be born simply means entering a new stage every day after leaving the previous one. It is common sense that the present stage is always certain as the individual always attempts to mould it according to his own liking or atleast to get adjusted with it whileas every new stage demands for new adjustments as it is beilieved to be wrapped up with uncertainty. The creative person enjoys to grapple with new uncertainties and delve deep to find out new possibilities. It needs courage and spirit of adventure. That is why is is said that creative person believes in adventurous life and this very adventurous spirit leads him to produce something new.

### **The Creative Person is known for Having Strange and Silly Ideas**

The creative individual has a reputation for having strange and silly ideas. No doubt, people sometimes laugh at him for his ideas but he has the courage to express himself fully and prove his ideas into practice. To confirm his ideas he goes on without losing his goal. He never believes in traditional or conventional thinking rather his tasks are judged by some uniquences or novelty. This style of life is also marked by bumour as is evident from his works.

In addition to this there is some empirical evidence that creative persons are more dominant and self assertive, more autonomous, more self-sufficient, more complex, more self- accepting, more open to the irrational in themselves, more feminine in characteristics, more stable, more radical, more self-controlled, more emotionally sensitive, more introverted but bold, and more resourceful and adventurous than others.

# 7

## Creativity in Education

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History reveals that there are periods when one dominant idea characterizes many facets of intellectual life, for example, in 17th and 18th centuries mechanistic determinism flourished in physics and was markedly reflected in philosophy and economics. Man always finds himself in the midst of such periods. He passed through biological evolution and stepped into the era of cultural evolution. The path of cultural evolution led him to the greatest intellectual excellence and he was able to solve some technical problems but still he is faced with many serious social, educational and economic problems. The solutions largely depend upon the minds of men. Whether they have been trained to think creatively or not rests with education.

Research in the field of creativity was seriously carried out from 1950 onwards and too long it was mainly the province of psychologists. But in recent years, educators also started doing systematic research on creativity to find out the new discoveries on the one hand, and add to the national development through the efficient use of multi-faceted talent on the other.

Researchers have shown that children are creative by nature for they have the innate ability to see new relationships and produce new combinations out of the existing things or their parts. They exhibit this tendency while in interaction with each other whether they are at work or play. This can blossom in them if their parents and teachers provide proper guidance and conducive environment to them. But it is distressing that in our schools proper attention is not paid to it. The teachers encourage students who are intelligent for them and who can give correct answer to the question. They hardly encourage students who are creative. Our school programmees also do not give due place to the

educational experiences and proper environment which are essential to the development of creative potential. Many factors may be responsible for this handicap. Either, our teachers do not have adequate understanding of the creative process and the factors which foster or stifle creativity among children or they do not tolerate children who are non-conformists. Vernon (1967) has aptly remarked that "the present system is criticised for favouring conformists mentality-the pupil who is good at accepting the learning what his teachers tell him and thinning along conventional lines whereas it discourages spontaneous and independent thinking".

Van Dyk (1973) says that if we accept that the development of a child is a process by which the highest order of involvement with the world is attained, then creativity should be the educationist's primary concern because this kind of experience (involvement) is creative in nature. In view of this it becomes imperative for our educational planners that they recognise the value of creative talent and re-orient the system of education to cope with this valuable talent. Getzels and Jackson (1962) too admit that our educational structure is hampering the development of creativity. Other researchers have also expressed the same views. Anderson and others (1970) say "that the problem is that we have not trained ourselves to cope with the creativity!! Torrance and safter (1986) go further and distressingly point to the fact that the teachers are ill equipped to meet the needs of students with respect to creativity. They do not know how to initiate, conduct, or evaluate creativity. They also feel uncomfortable with creative students. The need arises that this valuable human characteristic is recognised at its own rights and exploited by the educators for the survival and also better development of society.

### **Creativity in Teaching and Learning**

The purpose to educating the young is that they create a better world than we have created. They should create better works of art, science and literature; better livelihoods; and a more just system of distribution of wealth. More important is that they also create a peaceful world blessed with more creative freedom through their creative behaviour. But it is painful to see that our education system does not

reflect this in educational process. Not only our education system neglects but it too often suppresses the natural creativity of the young. Our teachers are interested in encouraging mostly convergent thinking ability in classroom and the children who is adept, in it is considered by them as intelligent one. Such students are encouraged by teachers as they follow the lines what their teachers dictate them. Such students are better known as conformists. Rarely such children are able to come out with original ideas of their own. There are other students who do not follow the conventional lines, teachers hardly care about them and label them as non-conformists. Mostly teachers get disturbed with their behaviour and do not pay due attention to the queries they raise. Their simple fault lies with their thinking in divergent ways and it is the divergent thinking abilities which are mainly responsible for making such students as non-conformists and unconventional.

This divergent thinking ability enables them to go off in many different directions, generating new information from the given information and arriving at varied and unusual solutions to problems. Such children do not get satisfied with the routine- type solutions to the problem like intelligent ones. They instead attempt to discover, invent, and come out with original ideas of their own. No doubt, both the thinking abilities have their place in life but it is the divergent thinking abilities which are possibly the most useful one as these help in dealing with new and complex situations of life.

Most of the subjects that are taught in the schools could, in particular be taught in ways that stimulate and develop the creative problem solving skills of students. What do we need to provide in the schools is not the content that may lead to quite predictable and uniform outcomes by the students rather the outcome should be of unpredictable and diverse nature. If we wish to create creative education for the young then we shall, at first, recognise that one of our main priorities should be to identify an array of problems in each of the fields we teach, as far as possible, that may provide children opportunities to create multiple solutions to identical problems. Next, we must help them to understand that most of the important problems they are likely to confront in their lives have several correct solutions, not simply one. Second, we must make it sure not only that the classroom tasks provide the children opportunities to formulate unique solutions to problems, but also,



equally important, that students have opportunities to learn how to formulate questions and problems themselves. Third, creative education should aim at cultivating the students' sensibilities, the ability to sensitively experience the world so that the content upon which the student can reflect would be expanded.

Education is understood a powerful instrument which can help students to realize the creative talent optimally and fully. The need, thus, is to shift from a mere routine type of teaching to creative teaching and creative problem solving.

### **Creative Teaching**

Creative teaching connotes two meanings, one the one hand it means teaching creatively which is possible when the teachers become more creative in aiding their learners. On the other hand, it means giving attention to creative problem-solving skills of students. In both the cases, the role of the student assumes great significance. He needs to be an active participant in the teaching learning process. He is personally responsible for his own learning. The role of the teacher should be only to stimulate, to guide, to provide a conducive climate, and the necessary equipment whileas, the student has not to be a passive learner rather he should discover himself what he learns.

Education should become more individualised so that each child is able to learn at his own pace and progresses accordingly. The child should make an effort to achieve the goal. He should have immediate and adequate feedback so as to get his efforts reinforced. Mostly, the feedback should come through intrinsic rewards.

The child should not rely only on memorization and storing of information rather he needs to develop skills that can be employed for using the information in new and newer situations.

Instruction should be based on presentation of problems and seeking their solutions. The student should be as courageous as to counter any challenging problem but due precaution needs to be taken in the selection of problems. Only such a problem should be presented that is challenging but not discouraging one for the students. While representing their solutions to the problem the teacher should in no way

make any personal criticism to the learners. One important point needs to be considered by the teachers that they attempt at understanding the intellectual capacity of each individual student fully so that they can use this information in a teaching-learning situation.

### **Teachability of Creativity**

The question whether children can be taught to think creatively or left to chance has been answered by many researchers. In fifties it was commonly thought that creativity, scientific discovery, the production of new ideas and the like had to be left to chance but torrance in 1964 in one of his lectures in Ontario contradicted this view. He lamented that how any reasonable, well informed person can still hold this view. The amazing record of inventions, scientific discoveries and other creative achievements amassed through deliberate methods of creative problem-solving should convince even the most stubborn skeptic. Both laboratory and field experiments involving these deliberate methods of improving the level of creative behaviour have also been rather convincing. Further, in his classes and seminars he observed that students improved their ability to develop original and useful solutions to problems.

Other researchers are also of the view that creativity should not be left to chance instead it should be fostered through deliberate methods. The evidence is strong that five year old children lose much of their curiosity and excitement about learning, nine year old children become greatly concerned about conformity to the pressures of peer-groups and give up many of their creative activities, the middle and high school students show a new kind of concern for conformity to behavioural norms with the result that their thinking becomes more obvious, traditional, common place and safe. In view of this, it becomes prime responsibility of the teachers to search out methods and techniques that they employ in teaching-learning process to help students to think creatively. The teacher is expected to perform this job only when he has the knowledge of those factors which inhibit creative thinking among students. He should make every attempt to eliminate such obstacles in the teaching-learning situation : (i) the pressure to conform is the major obstacle in eliciting creative responses. These pressures may come

either through teacher-chosen goals and activities or conventional tests and rigid curriculum; (ii) authoritarian attitudes as well as environments suppress the creative potential of young people as they put obstacles to the free, self-directive and self responsible learning. Authoritarian education directs students to learn only what others have already discovered and organised, and lays emphasis on following directions, to do what one is told to do, and to solve only those problems which have fixed and predetermined answers; (iii) threat or ridicule of any kind injures the feelings of self-worth in students and put blocks in the release of their creative potential; (iv) all types of external evaluation such as rewards or punishments or overemphasis on success arouses defensive attitudes in students and thereby inhibit creative responses. Inflexible defense mechanisms and compulsive fears the part of teachers also deter the productive tendency in students; (v) an excessive quest for certainty also inhibit the creative responses. Teachers instill this habit in the students while making the demand for right answers only. These attitudes afterwards are expressed by students in all the facets of their lives and stop thinking creatively (iv) Intolerance of the teachers to the playful attitude of students in connection with school work also stifle creativeness. Any innovation requires freedom to toy with ideas, and materials, deal with irrelevant objects and fantasy hence the environment of school which stops students from these experiences inhibit creativity in them.

### **Creative Teacher**

It is true that creativity cannot be taught by the traditional authoritarian methods and it is also true that creative teaching is the best and indispensable way for promoting creative behaviour in students wherein the teacher needs to invent such creative techniques during the process of teaching in the classroom which are unforeseeable and unexpected and put the students in surprise. Such experiences would, in turn, besides sustaining their interest in learning, induce students to think off different directions in order to come up with a large number of solutions to the problems. What techniques the creative teacher is expected to use in classroom are briefly discussed below :

The creative teacher provides for self-initiated learning on the part of students. The creative teachers creates such situations in the

classroom in which the students make an every effort for self-learning. It helps the teacher in eliciting creative responses from his students. Self-activity encourages students to make wild guesses, to explore, and to experiment with varied and different types of ideas. It induces spontaneous, and independent thinking among students. Most important is that students are motivated to learning on their own. This type of learning helps them in becoming self-starters.

## **2. Sets up Permissive Learning Environments**

Researchers have revealed that non-authoritarian learning environments facilitate creative learning as it is in the conditions of freedom which lead to creativeness. The kind of freedom which is requisite to creativity is psychological freedom in which students feel free to express themselves and in which external evaluations are absent. Freedom to engage in unimpeded symbolic expression promotes creative learning as it softens defensive and rigid attitudes and creates an openness to experience. Further, freedom to explore within the limits of one's own abilities places the responsibility for growth in one's own hands. On the contrary, every authoritarian act of the teacher not only discourages the decision making of students but also affects the learning of responsibility for their growth.

## **3. Stimulates Creative Thought Processes Among Students**

The creative teacher stimulates students to imagine, to think tentative solutions to problems, to attempt to seek for new connections among existing objects, materials or thoughts, build on the ideas of others, and use previous information in new directions and situations. He is encouraged to express theories which may appear ridiculous, unbelievable; to present information into new and unexpected patterns. Most important is that the creative teacher encourages student to take intellectual risks and to speculate.

## **4. Stimulates Intellectual Fluency and Flexibility Among the Students**

The creative teacher encourages students to store the information and use this varied situations. He stimulates them to come out with a

large number of ideas while attacking a problem. They learn to go to different and varied directions till they arrive at a novel solution to a problem. He encourages them to make a shift from simple observation to experimentation and not to fix up preconceived results. They learn to move from one approach to another in dealing with the materials at hand. He asks students to seek for new functions of common objects and to redefine problems. He encourages them to look for new meanings in familiar materials and to use old information in new contexts.

### **5. Imbibes Self-discipline Among Students**

This is the most important pre-requisite for creativeness. Unless students are self-disciplined it is not possible that they can release creative responses. Self discipline is a discipline which only the student can impose upon himself as it needs hardwork and drudgery which are required for any type of discovery or invention.

### **6. Promotes Sensitivity to Problems among Students**

The creative teacher assists students to become sensitive persons. Anything which is obvious may be ambiguous for a creative learner. The creative teacher helps them to become more sensitive to all external stimuli, to the moods and feelings of other people, to all social, economic, political, educational and other issues. Not only that, he also becomes sensitive to such issues which are unknown to others.

### **7. Fosters Curiosity among Students**

The creative teachers has the adequate knowledge how to make the best use of the question. As is known to all of us that every creative act begins with some questions, the questions should be operational and opened on the one hand and meaningful to students on the other and which do not have predetermined answers. Operational questions always lead to exploration which foster curiosity. Contrary to it there are questions which have pre-determined answers, hinder creativeness because in them the learner has no choice for wandering in search of varied solutions rather he gets restricted. Such questions hinder creative

responses among students.

#### **8. Assists Students to Become active Participants**

The creative teacher provides opportunities to students for manipulating materials, tools, ideas, and concepts. The active handling of objects facilitates creativeness among students as it helps the students in understanding various on-going processes. Second, the creative teacher encourage students to consider any problem as a whole instead of piecemeal as the understanding of problem occurs with greatest insight when it is observed from the view point of structural patterns and total structure.

#### **9. Encourages Self-evaluation on the Part of Students**

The creative teacher encourages students to evaluate their individual progress and achievement themselves. This means that the teacher accepts his students as an individual as of unconditional worth on the one hand and on the other, the student senses a climate of safety and learns that he can be what he is, since he seems to be regarded as of worth no matter what he does. In his way, the teacher builds up feeling of self-worth in his students. In its turn, the feeling of self-worth among students supplies the criteria for making choices of the means and materials which determine their pace of creation. The criteria for evaluating novelty is personal and individual's own powers to judge values serve as the final standard in determining the worth of newly created products.

The creative teacher not only believes in self-evaluation of novel products by the creators themselves but also refrains from making any judgement. He knows that by announcing outcomes or solutions he is inhibiting the exploratory efforts of the students, he postpones the finalizing of solutions. He does not close up the issues rather shows his willingness to re-open them and invite further solutions.

#### **10. Assists Students to become Adventurous**

The creative teacher cultivates the spirit of adventure in his students. He makes them adept to uncertainties and ambiguities of life

and how these can be faced as a challenge. How one can cope with frustrations and failures. Researches have shown that more creative persons have the ability to come out of uncertainties and ambiguities than less creative persons. Furthermore, the more creative person has the ability to draw new meanings from such ambiguities.

To conclude, the creative teacher encourages creative thinking among students in at least five different ways;

**Originality** : He welcomes original ideas from his students and also assists them in releasing more and more ideas, out of them some may be original. To be original means to break away from the obvious, the routine and the conventional. He can determine the originality of the responses advanced by students through statistical rarity. Statistical infrequency is the criterion to determine originality of a response. For example, if the similar response to a given problem has been advanced by more than five per cent then no value (score) is assigned to it. Only those responses are treated original that have been advanced by one per cent to five percent and the corresponding values range from 05 to 01.

**Novelty** : Novelty means that the product must be new. The newness can be determined subjectively as well as objectively. By subjectively we mean that there is something novel about the product for the creator while as newness of the object can objectively be determined in terms of statistical rarity or judged by a forum of some kind. Both are important however, the more important is the subjective assessment of the product in terms of its newness.

**Fluency** : Fluency is the ability to generate a large number of ideas to solve the problem. Other things being equal, the more ideas the student can command, the more problems he can solve. If he is fluent in his ideas then he can bring more immediately a fertile mind to his studies and can put what he has learnt to a wider use.

## **Inquiry**

This is the ability which makes one to become sensitive to problems by which he gets puzzled when others take it for granted. It ideas one to identify the best, most important or most effective from a number of alternatives.

**Elaboration**

To be able to elaborate is to make an idea viable. This ability requires from the student to learn on one's own initiatives, and through self-initiated learning.

**Openness**

To be open means is to resist premature closure. Openness calls for divergent thinking and implies many solutions to a problem and arriving at the most effective one. Openness also means playing with ideas, making wild guesses and arriving at a novel solution.

**Creativity in Art**

Art plays a vital role in the education of young children. The process of drawing or painting is a complex one in which the child brings together different elements of his environment to construct a new meaningful whole. By selecting, interpreting and reforming these elements he is not preparing a picture only rather he exhibits a part of himself as how he thinks, how he feels, and how he sees.

In our present system of education, much emphasis is laid on the learning of factual information. The passing of an examination, mostly depends upon the mastery or memorization of certain quantum of information on the part of the student. The school seems to have restricted its function of producing only such people who are able to vomit selected bits of information when asked to do that. That student who is able to produce the right bits of information at a proper time is considered fit for promotion to the next grade, what is most distressing is that the skill in repeating certain bits of information may have very little relationship to the person who is able to contribute significantly to the society.

It is worth mentioning here that more and more people are now realising that the ability to learn differs from one individual to another and this ability not only involves intellectual capacity but also social, emotional, perceptual and psychological factors. Our education system emphasizes on only one factor in human development i.e. it asks for



simple memorization of certain facts which is measured by the intelligence tests. As all of us now know that intelligence does not involve all the thinking abilities that are necessary to the survival of mankind. The other abilities which involve questioning, seeking varied answers, finding form and order, and seeking new relationships do not find their due place in the the present system of education.

One of the basic abilities that should be taught in schools is the ability to discover, to search for varied answers than to become a passive learner. The experiences central to an art activity involves this very ability. Second, the mental growth depends upon the relationship between an individual and his environment. In creative art activity there is an interaction between the self, the symbols, and the environment which provides the material for abstract intellectual processes. Such a relationship is considered as a basic component of a creative art activity. But what is emphasized mostly in our schools is to learn the letters and numerals. The students hardly are provided with the material by which their ability to abstract is developed. Third, the ability to see, feel, hear, smell and taste provides the means by which man can interact with his environment. If the child is given the training to use his all the senses during the process of teaching and learning there will be greater opportunity for him to learn. But what we observe in our schools, they hardly give due place to all the senses while educating children. To develop the sensitivity to problems is a basic ability involved in a creative art activity.

Fourth, students are not encouraged to be open, to give vent to their emotions in ways that are constructive. In a creative art activity we find that it provides a means to the children to express themselves in every open way. Young children have as many frustrations as adults and they may very well not be able to deal with these in a rational way. Being able to express emotions in a socially acceptable way provides a frame work for emotional growth.

Lastly, we require such an education system in which the development of the total being takes place, and each individual's thinking, feeling, and perceiving powers develop equally so that his creative abilities can unfold. This is to a great extent possible in the art activity.

## **Art Process and Creativeness**

No area in the elementary school curriculum provides more opportunity for children to grow in creativity than art. Art is based on experiences, and experiences are very personal, the end product can not be predetermined or dictated. It is a re-organisation of impressions in a way, that exhibits their unique significance for the creator. It is impossible to provide real learning situation without giving the individual an opportunity to use his imagination and inventive powers. Art activity offers such a situation to a child. Therefore, art provides the most important means to develop the individual as a creative thinker.

In spite of much research, still there are people who think of drawing and painting as being somehow removed from reality, and children seem to them possessing some magical power. In reality they are not empowered with magical power; they have the innate capacities with which they can manipulate their environment. The need is to provide them the adequate opportunities to develop their intellectual capacities.

Research reveals that there are, at least, five factors of creativity involved in any art process. These factors have been found, are at work while creating any piece of art, painting or sculpture. The first factor that has been identified in the creative process is sensitivity to problems, to attitudes, and feelings of other people. This ability calls for eyes not only to see but to observe; and hands not only to touch but to feel. Basically this is a central experience in working with any art material where the sensitivity towards a line or form is encouraged and developed at all levels. A small child can be sensitive when he touches any material and feels something; the 11th year old child can be sensitive towards colours; and the 16 year old boy may be sensitive towards something which is more exciting. Another factor that has been identified in creative process is fluency. This ability calls for thinking rapidly and freely on a problem and coming out with a large number of possible solutions. This ability we find in the numerous scribbles of a small child or a number of suggestions of a high school boy for portraying a picture or constructing something new. The third ability which is involved in the creative process is flexibility. This ability

enables children to shift from one thought to another in order to adjust with new situation and arriving at unique solution to the problem. This ability is reflected in all the types of art activities, for example, the paint may spill or the chisel may slip but the artist makes himself adept to it and continues this struggle, changes his thoughts rapidly till he completes his task. The fourth and the most important factor that has been identified in creative process is originality. This ability is judged by the product's unusualness and novelty. In every art activity we find, that if any mental factor is stressed more, it is originality wherein the copying of illustrations work from the teacher, books or other children is usually discouraged. The fifth factor involved in the creative process is the ability to redefine or reorganise which means to rearrange ideas, to see new uses of things or relationships. This ability is very central in any art experience, for example, in transforming paper bags into puppets, we are redefining the material in a new way in order to give it a new meaning and this very constant process of re-organisation brings out new discoveries and inventions.

The factors discussed above need to be considered by the teacher in planning an art programme. Most of these factors (abilities) fall under the domain of divergent thinking which is opposite to the convergent thinking. In schools, usually the convergent thinking is stressed more where the output of thinking is one correct answer or one acceptable solution to a problem. But in art, the stress is laid on divergent thinking where any number of outcomes in painting or drawing are correct. Any work of art requires men of having self-reflective thinking, curiosity, openness, adventurous spirit and believing in self-evaluation.

Research on creativity vis-a-vis art reveals that teaching for creativity is complex and may depend upon the teacher's personal meaningfulness as to how he encourages self-reflective thinking, and self-evaluation among his students and to what extent he can develop greater student teacher interaction. He should know that there are stages of development in art; that there are motivational and environmental forces that provide for learning to occur. What he does in the class and how he reacts towards the child makes a great difference in how the child views himself and his environment.

There are individual differences in children in regard to their personality characteristics as well as intellectual capacities. The teacher needs to know that there are some children who are sensitive and react to things around them more than others. They are able to create some piece of art. When they start their work, they begin with thinking of 'something' and this 'something' has a meaning for them, that is, a confrontation with their own selves and with their own experiences. On the other hand, there are other children who may not be thinking in this way. Either they may be lacking sensitivity or their minds may be blocked. They need to be motivated. It becomes the responsibility of the teacher to assist the child in reacting towards objects around him and his environment. It is believed that the required motivation and psychological climate may help the child in thinking, feeling, and perceiving objects around him.

The teacher may be more important for young children than older children as the latter can accumulate subject matter on their own for information. The older children can read, ask questions to clear their doubts, discuss issues with peers, or go to the library for gathering information whereas few of these things are available to the small children hence they need the guidance of an adult. The role of the teacher, therefore, becomes more important. It is he who determines the activities, gives support for action, passes on praises or criticism and decides the length of time to be spent on any art activity.

Some researchers have raised a question as to whether children are not restricted in their creativeness when the teacher is using classroom motivations, that is, when the whole group is motivated by one experience. Two things need to be differentiated clearly here. One is related to the subject matter and the other to the mode of expression. As long as the child is free to use his own mode of expression, his creativeness remains free and the position of the teacher comes down to mere guidance and to encouraging reflective thinking.

It is worth mentioning here that there is no single approach to freeing children in their creativeness or to making them more sensitive towards themselves and their environment. However, the teacher needs to consider at least, three factors while stimulating creative thinking among students. First, is his own personality, as to

what extent he is creative, sensitive and flexible. Second, is his own ability to put himself into the place of others. Third, is his understanding and knowledge of the needs of those whom he is teaching. It is upto the teacher to decide for the approach he uses. At one time he finds it better to divide the students into groups. At another time he may ask each individual student to work on his own. This all depends on the nature of activity on the one hand and individual needs of students on the other. The needs of the children change continually and the teacher must be too flexible to adjust to these changing needs. Sometimes, the outcome of the group approach is quite ineffective or even frustrating when the child feels that the group is interfering with his own individual mode of expression or simply he may not be ready for it.

The teacher needs to plan learning situations in the manner which will give each student an opportunity to grow in creativity. This task he can perform satisfactorily only when he has the adequate knowledge of stages of growth and development of children and of individual differences in them. In order to encourage creative thinking in his students, he needs to consider certain point in the process of planning the art programme. He must provide adequate and stimulating physical facilities to the students. It is the physical environment that plays an important role in developing creativity among students through art activities. In a physical sense, facilities are referred to as space and materials that should be provided to the students so as to enable them to explore, experiment and create. The classrooms need to be such where the students can work without any disturbances and distractions. Materials available to the students should be appropriate to their maturity level on the one hand and provide the widest possible range of choices tolerable to them on the other. The classrooms should be orderly and attractive. The whole arrangement should be functional, colourful and pleasing. Such an atmosphere in the classroom undoubtedly enhances the possibility among students to work for creative endeavours.

Opportunities for children to act upon their environment with their present state of knowledge, even if their actions are neither efficient nor completely understood by the teacher, are of great significance in the educative process. The opportunity to explore the unknown or to manipulate or alter the known provides support for



children's efforts to think independently. They need to take chances, to question, to see alternative avenues for action. One of the ways to provide for greater alternatives for the child is to expand his frame of reference, that is, what the child is doing now, how can this be modified, altered or restructured in ways that can be understood by the child. A teacher who asks for alternatives is actually providing the child an opportunity to look for other directions.

Next, the art teacher needs to consider the emotional aspects of the environment so as to enable the learner to be free and to be open to accept the new challenges. It has been observed in research that the art work suffers if the teacher is dictatorial and oppressive and it progresses if he is able to create a conducive climate. The teacher should know that before children will or can share their inner-most thoughts and feelings through art forms, they must be free and comfortable in the group and feel that their feelings and ideas will be accepted by the group members as well as the teacher. The more the teacher can do is to provide for adequate sessions of conversation and discussion to the children that will encourage them to contribute towards creative thinking.

The most important task of the art teacher seems to construct such a curriculum which may be rich enough to provide opportunities to each learner develop in accordance with his own pace. On the one hand and ensures desired growth rather than to a routine pattern on the other. Growth proceeds most effectively when children are placed in situations which call upon them to speculate, analyse, synthesize, sharpen sensory impressions and to go beyond the situation where the teacher has left it.

The art teacher should assist students to become sensitive learners as sensory awareness is especially important for creative thinking in the area of art. It has been seen that children often overlook and miss the familiar objects in the environment. Sensory awareness means using eyes not for simple recognition but piercing through the detailed visual relationships which make the whole impression; using the ears not for hearing only but for nothing the detailed relationships of sound. The teacher can make his students aware by turning their attention towards various objects in the environment by asking them to observe and compare shapes, colours and patterns of light and shade; listening to

different sounds and identifying them; touching many things and have the feel of them and enjoying and discussing different motions of the body, machines and other objects.

The teacher can also made his students students sensitive towards the works of great artists which in turn will leave a favourable effect on their own art work. By comparing their own explorations with the art work of great people they can grow in the understanding that art in an expression of that what the artist can imagine, perceive and feel and not just a photographic reproduction.

### **Creativity in Science**

The theoretical as well as empirical discussions have brought to our knowledge different types of creativity. The first type of creativity in which the product of creation is an expression of the inner states of mind is expressed in the works of artists, painters, poets, novelists, etc. as discussed in the previous section. The second type of creativity in which the product is not related to the creator, or his inner states is expressed in the research works of scientists, engineers, chemists, biologists, etc. In this type of creativity, the creator acts only as a mediator, between externally defined needs and goals. The creator simply operates on some aspect of the environment in such a manner as to produce a new product but he adds little of himself to the product.

In scientific creativity, the envirnmental needs and goals are of prime importance. It is also akin to problem solving creativity. Scientific creativity involves situations concerning the solutions of mechanical and social problems. This is mostly the fact-finding endeavour, using abstract type of creativity to arrive at the scientific discoveries. Scientific creativity is also termed as objective creativity which is judged by the appropriateness, i.e. whether the product fulfills the demands of the situation.

In Koestler's (1964) view, in scientific thinking nothing like complementary and self-assertive emotions are involved, Scientists mostly have been observed as having very few interpersonal relationships and keep a distance from their personal emotions, instead they devote energies and thoughts to impersonal matters and objects.

This does not mean that their thinking is totally devoid of all feelings but it is well balanced compound of passions into which both self asserting and participating tendencies enter into highly sublimated form, which provide new insights.

Different conditions have been found necessary for scientific creativity. Psychoanalysts attach great importance to regression in scientific creativity. Psychologists largely agree that psychological, sociological and economic factors are most vital for the development of scientific creativity. While assessing the environmental conditions and creative thinking abilities of scientists, Andrews (1967) could find only simple relationship between the two. However, on further investigation he noted that it is the man's laboratory environment which matters in his creative production.

Creativity as has largely been agreed upon can be developed and each person, at least can be trained to think creatively. The same holds true for any student whether he belongs to art or science provided the necessary conditions are provided to him. Terman (1954) believes that scientific creativity in students can be enhanced in a climate and by techniques which can, in part, be created on the basis of a knowledge of those characteristics which distinguish creative from non-creative future scientists.

It is not necessary that all future creative scientists have the same characteristics which distinguish past and present scientists from their peers. On thing seems important being the ideal climate. If an ideal climate is provided, chances increase for the future scientists to become more creative.

Of all the characteristics of a creative scientists the one which is most related to his public image is his imaginative and unorthodox thinking. Nothing is spared his curiosity. He has neither respect for the past nor for the present. He is future- oriented in his ideas and is quite willing to make bold leaps into uncharted territory, guided principally by insight. This characteristic may be because of his over-whelming interest in reading in general and reading science fiction in particular.

The creative scientist, sometimes, goes for day dreaming also but knowing well that reality is something else and attempts at bringing his



dreams to reality. He is more interested in goals than the method used to achieve it and is likely to support his conclusions with vigour. This tendency not only makes his mental peace disturbed, but also to the teacher who wishes him to mould in conformity.

Creative scientists are said having a high tolerance for ambiguity. They actively seek for situations and problems characterised by complexity and discomfort, not only for the challenge they present but also for aesthetic satisfaction in the elegant solution for which they hope. Mental effort, then is to the creative scientist what physical exercise is to an athlete—a chosen activity and a necessity.

Creative scientists are particularly open to new experiences. There have been found two factors responsible for the development of this characteristic in them. Either, the families of these children moved more often than most, or, as children, they have been left alone for long periods of time during which they have to seek for their entertainment on their own. These circumstances, possibly help them in developing their wide interests and long interest spans and are not inclined to feel circumscribed by their environment.

A creative scientist works very hard and persistently. He is very independent, and democratic in nature. He studies each and every thing in detail. This characteristic he develops as a result of his home climate which is mostly characterized by imbibing self-discipline among children and learning to satisfy desires through delayed satisfaction. Thus attaining a goal after much persistence, the resolve and creative thinking of an individual get stimulated.

A creative scientist finds ways to reduce demands of the society on him so that he has time to think. He generally starts slowly on a problem, looks at it through many angles and increases his pace as he proceeds. He works furiously when he reaches the climax stage of success of the problem. Until he reaches the solution of the problem he is fully involved with the problem over extended periods of time.

Creative scientists, on the average are emotionally cool, aloof, dominant and introspective. It has been observed that as children they like to be alone though companionship was available to them. They are said to be not too intimate with their families. They are more socially

concerned than sociable. They prefer problems related to things more than problems that are related to people.

Creative scientists are more sensitive to approval and disapproval. In spite of having a good self image, they need social recognition and aspire for rewards in order to continue producing their creative works. Similarly, they tend to learn most from those who are demanding but fair.

In regard to scientific creativity, a teacher has a variety of relationships with his students. To one he is a friend, to another he is taskmaster. The teacher who fully understands the student's creative tendency towards introversion will offer him a friendly, supportive relationship and also respecting whatever psychological distance he prefers. In order to encourage creative thinking, a creative teacher is willing to consider any question, any topic, at any time raised by his students. A teacher who attempts at fostering creative thinking in his students is described by them as perceptive, kind, appreciative, but sometimes critical also.

To enhance creativity in science students, a teacher should be too flexible and humane. He should be socially conscious, individual-concerned human being first and the educator second. He should be knowing as to how enough of variety in course content could be brought about. He should know the proper use of audio-visual aids, conducting lectures of the outside speakers, arranging field trips, debates, seminars, quiz, discussions, etc. that help in the development of imagination and divergent thinking.

It would not be possible for a teacher to stimulate creative thinking among students unless a restructuring of the overall curriculum takes place. The courses need to be revised in the manner that ask for raising student's interest in complexity to develop an inquiry mind. Puzzles, paradoxes and conundrums should also find their place in the curriculum. To cater to the creative scientist's desire for resolvable disorder, the content should correspond with complex concepts more often than is done today.

On the one hand, one value in required courses should be that they train students in the quality of persistence without which there can

be no creativity. On the other hand, we must strike a balance, since to be creative, an individual must have un-programmed time. Our pattern of required classes, home assignments, and entertainments must be liberalized in order that the students have the necessary opportunity for reflective and creative thinking. An educational institution should ensure that every student, especially the creative one, is working hard, however, in some cases, the individual student can profit if allowed to go with his own chosen academically accepted projects. That is, schools must be rigid enough to force the lazy students to study and flexible enough to let the highly motivated one set his own pace. We need not, for instance, be strict with all students about class attendance and deadlines, but we must ask for overall performance. One thing however, should be remembered that there are students who won't think unless they are forced to; others cannot exert their best efforts or develop to their full potential under excessive pressures to meet rigid classroom requirements. Only individual-oriented teachers are regarded to resolve this double faceted issue.

Since many creative scientists are said to be introverts, others like to be with people and benefit from close association with their classmates and teachers. The job of the teacher remains to encourage non class activities such as attendance at professional meetings and lectures; publication programmes, visits to other institutions, libraries and museums wherein the students have an opportunity to interact with other students, teachers and people. Such contacts with imaginative and critical people help students develop their own imaginative thinking.

## Identification and Measurement of Creative Talent

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Efforts to develop tests to assess intellectual abilities started towards the end of the last century. The first test of intelligence was developed by Binet, a French psychologist in the beginning of the present century. Consequently, a large number of verbal and non-verbal tests of intelligence were developed in different parts of the world. These tests soon gained so much popularity that people tied careers of their wards with intelligence quotient as revealed by these tests. In spite of the fact that these tests failed to identify special talents, yet they remained to serve as sole predictors of intellectual abilities, and also of a wide range of behaviour.

Terman has pointed out that the IQ has effectively delimited not only the most successful students and the best achievers in the academic world, but also those most effective in human relationships, and in a wide range of other socially approved activities. Getzels and Jackson (1962) have the conventional intelligence tests as sampling a narrow band of intellectual abilities. Catell (1963) labelled these tests as maintaining a particular conceptualization of intellectual ability through having had the criterion built into them. Getzels and Jackson, 1959; Torrance, 1959; Mackinnon, 1959 have also pointed out that intelligence tests are not very effective measures of creative potential; intelligence, as measured accounts for only a small part of the variation in creative performance. In view of the shortcomings of these tests, there has been an increasing interest in the development of creativity tests.

The development of creative tests led to a considerable

controversy concerning the distinction between the kinds of abilities sampled by creativity tests and those sampled by intelligence tests. The other technical issues connected with these tests include question of validity and reliability. A major question in attempting to demonstrate the validity of tests claiming to measure creativity is that of establishing a criterion of creativity. Just what is regarded as creative varies not only from society to society, but from person to person, and even from time to time within a given society. In view of this, different researchers have used different criteria to study creativity such as production of works generally acknowledged to be creative (a poem or a novel); public acclaim for creative eminence; or a judgement by peers as having made a creative contribution. Since creativity manifests itself in a variety of styles and also ranges across a wide variety of fields, it is likely that many criteria may emerge. Therefore, to attempt to validate creativity tests means to defining the criterion against which they should be tested, is a serious problem (Cropley, 1972).

The second question relates to the relationship of creativity tests to conventional tests of intelligence. One approach to this question has been to comparing scores on creativity tests with those on intelligence tests, and to show that creativity tests sort people out in a somewhat different way from that which results when IQ scores are used. Torrance (1959) has pointed out what selection of talented individuals purely on the basis of IQ scores overlooks a substantial group of people who obtain high scores on creativity tests but not on intelligence tests. Some studies have shown fairly low but significant correlations between scores on intelligence tests and creativity tests while as, some have reported high correlations between the two. However, some researchers in a recent work employed Wallach and Kogan's derivatives of the earlier creativity tests and administered them on an individual basis, with all recording of responses done by the testers and not by the subjects. They reported substantial correlations among both the creativity tests and intelligence tests, but low cross-correlations between creativity and intelligence tests. Similar results were reported by Cropley and Maslany (1968) in the case of high school and University students.

The contradictory findings between intelligence and creativity point to the construct validity of creativity tests. According to Wallach

(1970), independence from conventional intelligence tests is obtained when the creativity tests emphasize ideational fluency, whereas high correlations with intelligence tests result when emphasis is on verbal facility or vocabulary size. Wallach's conclusion suggests that the creativity tests be administered without time limits, since time limits necessarily limit ideational fluency by cutting off the flow of ideas and hence also restrict creativity. Wallach's emphasis on ideational fluency as the key element of creativity test is highly consistent with Guilford's divergent thinking in which he has identified eight abilities out of which four belong to fluency domain.

### **Development of Creativity Tests**

It was Dearborn who first attempted in 1898 to study the imaginative responses of Harvard students and faculty to a series of inkblots. Since then, a number of different tests were developed for the measurement of divergent thinking abilities. Besides inkblots and other objective devices, analogies have been used frequently to obtain measures of creative thinking abilities of adults.

Efforts to develop instruments for assessing creative thinking abilities continued to be made. Some could identify one factor of creativity, others more than one, Chassell (1916) indicated originality by using a battery of twelve tests; Simpson (1922) identified fluency, flexibility and originality; and Hargreaves (1927) scored the responses of his subjects for fluency and originality. Elizebeth Andrews in 1930 developed a number of different tests similar to those included today in divergent thinking test batteries. Similar efforts were made in the thirties and forties, until Guilford first undertook the task on a systematic and large scale basis in his factor analytic studies of various thinking abilities including creativity. Besides factor tests of Guilford, Torrance, Getzels and Jackson constructed their batteries including the complex tasks presumed to involve the creative process whileas the tests of creativity developed by Wallach and Kogan are based on the associational concept of creativity. These tests measure different factors of creativity that are as follows:

**Fluency :** The ability to produce a large number of ideas.

**Flexibility :** The ability to produce a variety of ideas.

**Originality :** The ability to produce ideas that are novel.

**Elaboration :** The ability to fill in details.

**Sensitivity :** The ability to perceive deficiencies.

to problems and evaluate implications.

**Redefinition :** The ability to define in a way different from the usual, established or intended way.

### **Guilford's Tests of Divergent Production**

Guilford and his associates have developed various tasks for the assessment of abilities that are related to creativity. Creativity, the divergent thinking in Guilford's terminology includes abilities of fluency, flexibility, originality, elaboration, sensitivity to problems, and redefinition. Some of these tasks are briefly explained as under:

1. **Idea Production :** This task aims at measuring four types of fluency such as : ideational, expressional, associational, and word fluency. The subjects are required to give as many uses of an object or ideas as he can. Some examples of this task are:

**Headings :** Write as many headings as possible of a given story.

**Uses :** Write as many uses of a given thing as you can.

**Descriptions :** Describe a given incident by giving as many ways as you can.

**Topics :** Write as many ideas as possible for a given work.

**Themes :** Write as many words as you can about a give theme.

**Thing Categories :** List the names of things that are round or that could be called round.

**Word arrangements :** Write four-word sentences when the first letter of each word is given as w....c....e....n.

**Controlled Associations :** Write as many synonyms as possible for each given word.

**Simple Insertions :** Write adjectival completion for the given simile.

**Associations :** Write a word that can be associated with two given words (Say, chair-Table).

**Prefix :** Write words with a given prefix.

**Suffix :** Write words ending with a given suffix.

**First and Last Letters :** Write words beginning and ending with the given letter.

**2. Alternate Uses :** This task aims at measuring two types of flexibility spontaneous, and adaptive in thinking. The subjects are required to give uncommon uses of a given object. A few examples of this type of test activity are given as under.

**Uses of Things :** Write a variety of uses of each given thing.

**Alternate Uses :** List different uncommon uses of a given object.

**Match problem :** Indicate several different patterns of matches that can be removed to leave a specified number of triangles or squares.

**Unusual uses :** Give different types of uses of a given object.

**Plot Titles :** Give many appropriate titles for a given story.

**3. Consequences :** This task requires subjects to produce new ideas. The following activities included in this task assess the "originality" among subjects:

**Plot Titles :** Write clever titles for given story plots.

**Symbol Production :** Present symbols to represent given activities and objects.

**Consequences :** Put down remote consequences of certain changes.

**4. Figure Production :** This task aims at assessing the ability "elaboration" by asking subjects to produce figures. The main activities in this task are :

**Planning :** Given as many detailed steps as necessary in planning



a play.

**Figure Production :** Add to given lines to produce a meaningful figure.

**5. Improvements :** This task aims at assessing the ability "Sensitivity to Problems". The subjects are required to complete the following task:

**Apparatus Test :** Suggest two improvements for common appliances and useful objects like telephone, electric heater, etc.

**Seeing Problems :** List problems that might arise in connection with common objects.

**Seeing Deficiencies :** point out ways in which a described plan or activity is faulty.

**6. Hidden Pictures :** In this task, the subjects' ability "redefinition" is assessed. The subjects are required to complete the following tests:

**Concealed Figure :** Indicate which of four complex geometrical figures contain a given geometrical figure.

**Camouflaged Words :** Find within a meaningful sentence a group of consecutive letters that, in the given order, spell the name of a sport or game.

**Hidden Figures :** Indicate which of five figures is hidden in a given figure.

**Hidden Pictures :** Find human or animal pictures hidden in a scene, as rapidly as possible.

**Hidden Word Production :** Write sentences or phrases that contain given words, either split or embedded within the sentence or phrase.

**Picture Gestalt :** Indicate which object in a photograph will serve a specified purpose.

**Object Synthesis :** Name the object that could be made by combining two specified objects.

**7. Numerical Tests :** This task is described by Guildford as a test

for the divergent production of symbolic relation (DSR). The subjects are required to make as many sums as possible with the given figures.

### **Torrance Tests of Creative Thinking.**

Torrance developed a battery of test activities, two of which are verbal and two figural. Both the verbal and figural forms can be used from Kindergarten to graduate level. As group tests, figural forms can be administered to all the stages of education whileas verbal from 4th Grade onwards. Below the 4th grade, the verbal test can be administered to students orally and individually in order to obtain valid and reliable results.

The tasks or activities included in the tests may be classified into three major categories : verbal tasks using non-verbal stimuli; verbal tasks using verbal stimuli; and non-verbal tasks.

These tests have been used in, at least, 26 Doctoral Works and projects in India so far (Raina, 1991).

### **Verbal Test**

The verbal test is available in two forms, Forms A and Form B. Each form contains six activities and requires a total of 45 minutes to complete. Each task requires the subject to think in divergent directions, in terms of possibilities. The first two activities in the test, involve non-verbal stimuli, i.e. a picture or a drawing, and the other three activities involve verbal stimuli. A brief description of the activities is given as under :

#### **1. Ask-and-Guest Test**

In this activity, the subject is provided an opportunity to show how good he is at asking questions and finding out things that he does not know. He is asked to write as many questions as he can think of, about the picture given in the test. He is urged not to ask such questions that can be answered simply by looking at the picture. He can look back at the picture as and when he likes to do so.

Next, they are asked to write as many possible causes as they can about the action shown in the given picture. They are told that they may use things that might have happened prior to the things that are happening in the picture, or something that had happened a long ago that made these things happen. This activity provides an opportunity to the subjects to use their thinking abilities in developing hypotheses and to think about possibles.

## **2. Consequences**

This activity also provides an opportunity to the subjects to use their ability in preparing a picture to develop hypotheses with reference to consequences. The subjects are asked to write as many possibilities as they can in regard to what might happen as a result of what is happening in the picture. They are told that they may use things that might happen just afterwards or things that might take place after a long period of time in the future.

## **3. Unusual Uses**

In this activity, the subjects are required to think of as many unusual question as they can about Tincans. This activity requires two things from the subjects, that is, the number of questions they are capable to produce, and the unusualness or uncommonness associated with these questions.

## **4. Just Suppose Activity**

This activity is basically an adaptation of the consequence-type test in Guilford's battery of divergent production and is a variation of the Guess consequences activity of the Ask-and-Guess series. The variation was made in order to elicit higher degree of spontaneity. As in the consequences test, the subject is faced with an improbable situation and asked to predict the possible outcomes by introducing a new or unknown variable. The subjects are told to think about all other things that would happen if the given improbable situation were to come true.

## **5. Improvements**

In this activity, a toy-monkey is presented to the subject and he is asked to suggest the most clever, the most interesting, and the most unusual ways he can think of for changing this toy-monkey so that children will have more fun playing with it.

This activity is attractive from the stand point of administration and eliciting novel responses from the subjects. It gives an opportunity to the subjects to "regress in the service of the ego" and enables them to play with ideas that they would not like to express in other tasks.

### **Figural Test**

The figural Test is also available in two forms, Form A and Form B. This test consists of three activities and requires thirty minutes to complete. These activities are designed so to obtain maximum information from a minimum of time. The three activities included in the test are described briefly as under :

#### **1. Picture Construction Activity**

This task requires the subjects to think of a picture in which the given shape made of coloured paper with an adhesive backing (in form A, a tear drop or paper shape; in form B, a jelly bean shape) is an integral part. The subjects are urged to think of something that no one else in the group will produce that may be original. Make the picture such that it reveals as complete and as interesting a story as possible. The product, thus, produced is evaluated for originality and elaboration.

#### **2. Incomplete Figures Activity**

This activity contains ten squares, each comprises a different stimulus figure. The subjects are asked to add lines to the incomplete figures in order to sketch some interesting picture or objects. They are told to think of some picture or object that no one else will think of. They are also required to suggest an interesting title for each of their drawings. Each figure, thus, developed is evaluated for originality, elaboration and flexibility and titles for originality.

### **3. Repeated Figures Activity**

In this activity, the stimulus material in Form A is 30 parallel lines and in Form B it is 40 circles. The subjects are required to make as many objects or pictures as they can from the stimulus material. They are also told to think of things that no one else will think of. They are also required to suggest titles or names of the objects they have developed. The product, thus, created is evaluated in terms of fluency, flexibility, originality and elaboration.

### **Getzels and Jackson Tests of Creativity**

Getzels and Jackson constructed their batteries on creativity with a view to developing complex tasks presumed to involve the creative process. The responses were evaluated for fluency, flexibility, originality and elaboration. In the preparation of different measures of creativity, they have borrowed some of the ideas from Guilford. The five measures of creativity, they have developed are as follows :

#### **1. Word Association**

In this test, the subjects are required to give as many definitions as possible for fairly common word, such as 'bolt' or 'sack'.

#### **2. Uses of Things**

In this test, the subjects are required to give as many uses of an object as they can give. The objects are : brick, toothpick, etc.

#### **3. Hidden Shapes Test**

In this test, the subjects are shown a card with a simple geometric figure on it, and are required to develop the figure in a more complex form or pattern.

#### **4. Fables Test**

In this test, the subject is presented with short fables from which

the last line is missing. The subject is required to suggest three different endings for each fable, among which one should be a moralistic; another, a humorous; and third, a sad one.

### **5. Make-up Problem**

Here, the subjects are presented with a number of complex paragraphs. Each paragraph contains many numerical statements. The subjects are required to make-up as many mathematical problems as they can on the given information.

### **Wallach and Kogan Tests of Creativity**

Wallach and Kogan (1965) developed tests of creativity based on the associational concept as discussed elsewhere. Their measures are aimed at exploring creativity by generating five types interest was in measuring two related factors : the number of unique responses produced, and the total number of responses produced.

These measures are labelled as games and are administered individually. There is no time limit for giving responses to any of these measures. One advantage of these measures is that the test provides a game like situation and that the threat of test being non-existent, make children more free in expressing their responses. The test contains five tasks, out of which three involve verbal stimulus materials, and two tasks involve non- verbal stimulus material. A brief description of the activities is given as under :

#### **1. Instances**

In this activity, the child is required to generate possible instances of a class concept that is specified in verbal terms. Some sample items of the task are :

- i. Name all the round things you can think of.
- ii. Name all the things you can think of that will make a noise.
- iii. Name all the square things you can think of.

## **2. Alternate Uses**

This activity requires the child to give possible uses for a verbally specified object. The task consists of eight items, three examples of which follow :

- i. Tell me all the different ways you could use a newspaper.
- ii. Tell me all the different ways you could use a knife.
- iii. Tell me all the different ways you could use a cork.

## **3. Similarities**

In this activity, the child is asked to generate possible similarities between two verbally given objects. There are ten items in this task. Some sample items are :

- i. Tell me all the ways in which a potato and a carrot are alike.
- ii. Tell me all the ways in which a cat and a mouse are alike.
- iii. Tell me all the ways in which meat and milk are alike.

## **4. Pattern Meanings**

This measure involves visual stimulus material. There are eight items in this measure. Each drawing appears on the separate card. Each of the eight cards are presented to the child, and asked to generate possible meanings or interpretations for each of the abstract visual designs. He is instructed to consider each drawing as a complete entity in producing his responses.

Sample Item : Here is a drawing. Tell me all the things you think this could be.

## **5. Line Meanings**

In this activity, the child is faced with one or another form of line and is asked to generate meanings or interpretations relevant to the form of the line. There are ten items in this activity. Each line is presented on a separate card.

**Sample Item :** Here is the first line. You can turn it anyway you like. Tell me all the things you can about it. What does it make you think?

In India, the research on creativity can be traced during sixties. The researchers used either Torrance tests of creative thinking or Guilford's tests of divergant production. It was only in seventies that the identification and measurement of creativity has attracted the attention of Indian researchers. The tools they developed either followed the pattern of tTorrance tests or Guilford's tests. Passi (1971) and Mehdi (1973) developed battery of tests of creativity, the description of which follows.

### **Passi Tests of Creativity**

Passi (1971, 1979) developed a battery of tests of creativity in English and Hindi for the purpose of measuring creativity in school Children. In all, both verbal and Non-verbal comprrses six tests, viz: (i) The seeing problems test, (ii) the unusual uses test, (iii) the consequences test, (iv) the test of inquisitiveness, (v) the square puzzle test, and (vi) The Blocks test of creativity. These tests have been classified on the lines of Torrence (1962) the description of which follows:

- a) Tests consisting of verbal tasks, namely, the seeing problems test, the unusual uses test, and the consequences test;
- b) Test with verbal respons tasks using mostly non-verbal stimuli, namely, the test of inquisitiveness;
- c) Tests consisting of non-verbal tasks comprising the square puzzle test and the Blocks test.

### **Description of Tests**

(i) *The seeing problems test.* This test has been developed on the lines followed by Guilford, et. al (1952). It has been designed to measure a factor of sensitivity to problems which is a component dimension of creativity. The test is proposed to measure the ability to comprehend problems concerning the working of simple and handy



articles of common use. The responses are scored for fluency.

(ii) *The unusual uses test.* This test has been designed on the lines of the Brick uses Test of Guilford, et. al (1952) and Torrance's (1962) the unusual uses Test. The test includes the names of things which have proximity with the psychological and physical environment of the subjects and could be used for numerous purposes. The responses are scored for fluency, flexibility and originality.

(iii) *The consequences test.* This test is based on the pattern followed by Guilford (1952) and Torrance (1962)'. The test measures the dimensions of fluency, and originality.

(iv) *The test of inquisitiveness.* In order to provide an unfamiliar and novel situation, the test includes a relatively less familiar object providing sound and movement as the test tent, viz, a metronome. In order to provide a situation for greater inquisitiveness a playcard bearing in capital letters "A few children cannot touch it" is displayed alongwith metronome in a working condition. The responses are scored for inquisitiveness.

(v) *The square puzzle test.* This test aims at measuring persistency with the help of a performance test. A difficult situation is set up for the subjects with the help of a puzzle. This test consists of five identical right-angled triangles and five identical quadrilaterals and subjects are required to construct a square by using all the ten given pieces without leaving any gap for overlay in between the pieces. The scores are obtained for the divension of persistency.

vi *The blocks test of creativity.* This test is a performance test and is administered individually. This test chiefly follows the pattern of the Lowenfeld Mosaic Test (1952) and is regarded as a useful tool for providing greater opportunity to observe individuals engaged in performing dynamic designs.

The Blocks test consists of nineteen identical cubes and Twelve diagonally-cut semicubes. The material provided two types of blocks and three types of surfaces, viz, squared, rectangles and right-angled triangles. The six surfaces of the cubes are painted in red (top), blue (bottom), yellow(face), green(back), white (left side) and black (right side). The twelve diagonally-cut semicubes have in all twenty four

right-angled triangular surfaces, twenty-four squared surfaces and twelve rectangular surfaces. The subjects are required to produce as many interesting and unusual designs as can be possible in ten minutes. They are further required to write down the headings (titles) of the designs. The scores of fluency, flexibility and originality are proposed to be scored from the designs and structures.

The reliability of the tests have been computed by using Test-retest and split-half methods. The test-retest reliability coefficients range from 0.68 to 0.97 and Split half reliability coefficient 0.51 to 0.88.

The concurrent, i.e., convergent, divergent and factorial validity methods have been employed to validate the tests of creativity. For convergent validity, the correlation coefficients range from 0.43 to 0.95 and discriminant validity 0.27 to 0.35.

### **Mehdi's Tests of Creative Thinking**

Mehdi (1973) developed a battery of tests of creativity in English and Hindi. These tests, both verbal and non-verbal are meant to identify creative talent at all stages of education except pre-primary and primary. The types of tasks involved in the tests have been chosen so that they could be most easily and economically administered.

#### **Verbal Test**

The verbal test includes four sub-tests, viz. consequences test, unusual uses test, similarity test, and product improvement test. A brief description of the sub-tests is given as under :

1. *Consequences test* : This test consists of three hypothetical situations and the subject is required to think and write as many consequences of the given situations as he can. The situations being hypothetical, minimize the effect of experience and also provide the subject with an unlimited opportunity to make responses with his own imagination and originality. The time allowed for this activity is fifteen minutes.

Sample item : What will happen, if man flies like birds?

2. *Unusual uses test* : This test presents the subject with the names of three common objects and requires him to think and write as many novel, interesting, and unusual uses of these objects as he may think of. This activity intends to measure the ability to retrieve items of information from his personal information in storage. The time allowed for the three tasks is four minutes each.

Sample Item : Piece of stone.

3. *New relationships test* : This test presents the subject with three pairs of words apparently different and requires him to think and write as many novel relationships as possible between the two objects of each pair. This activity also provides an opportunity for the free play of imagination and originality. The time allowed for this activity is fifteen minutes.

Sample Item : Tree and house.

4. *Product improvement test* : In this test, the subject is asked to think of a simple wooden toy of a horse, and suggest and write addition of new things to it in order to make it more interesting for the children to play. The time allowed for this activity is six minutes.

*Non-verbal Test* : This test is intended to measure the individual's ability to deal with figural content in a creative manner. Three types of activities that have been framed for this purpose are picture construction, picture completion, and triangles and ellipses. The total time required for completion of this test is 35 minutes. A brief description of these activities is given below.

1. *Picture construction activity* : This activity presents the subject with two simple geometrical figures : a semi circle, and a rhomb, and requires him to construct and elaborate picture using each figure as an integral part. Emphasis is put on originality and elaboration. Originality is judged by the novelty of the picture, and elaboration by adding pertinent details in the picture so that it tells a complete and an interesting story. The subject is also required to give an interesting and unusual title to each picture. Ten minutes are allowed for this activity.

2. *Incomplete figure activity* : This activity consists of 10 line drawings which could be made into meaningful pictures of different

objects. The subject is required to construct different pictures and give suitable title to each picture. Each item is scored for originality and elaboration. Time allowed for this activity is fifteen minutes.

3. *Triangles and ellipses activity* : This activity presents the subject with seven triangles and seven ellipses and requires him to construct different meaningful pictures based on the two given stimuli. He is also asked to give suitable title to each picture. Here, also the items are scored for originality and elaboration. Ten minutes are allowed for this activity.

Test retest reliabilities of both the tests (verbal and non-verbal) are quite high. For the total creativity score the reliabilities for verbal and non-verbal tests (N=31 and 50) are 0.959 and 0.946 respectively. For factor scores, the reliabilities 0.823 to 0.947 for the non verbal test.

Validities with teacher ratings range from 0.29 to 0.40 for fluency; 0.31 to 0.34 for flexibility; and 0.26 to 0.39 for originality. In another validation study, where teacher ratings on ten personality traits relevant to creative thinking were used, the correlations with the total rating came out to be 0.222 for the verbal test, 0.385 for the non-verbal test.

## Development of Creative Talent

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The fact that creativity is found in every living cell is realised fast now. Creativity is not a property of the elite only, it is found in every person, the only difference being that in some it manifests more than others. Neither it is sole prerogative of certain professionals like artists, poets, painters and scientists, nor it is confined to only certain conventional areas of human endeavour, it is existent in every living cell, and also in all the fields of human endeavour.

Too long man has been operating on the erroneous belief that creative behaviour is an all-mysterious spark that in a few rare geniuses was added on to the normal aggregate of human potentialities. Until 18th century, the word creation was used only in regard to the works of God. Poets and dramatists were regarded as the mouthpieces of gods. But now the modern psychology has proved that creativity like other mental abilities can be manifested in some way and to some extent by almost everybody. While discussing creativity Maslow calls an uneducated woman who is a full time housewife a creative cook and a perfect tackle of an athlete a creative product as a sonnet. Creativeness is found in every field of human endeavour whether it is soup-making of a cook, playing of games and sports, running a business, building interpersonal relationships, teaching and learning and even raising of children.

Actually man's creative products both verbal and non-verbal are quite observable. Man's behaviour which creates these products is also observable. Thus, we must realise that creative thinking abilities can be developed to varying degrees among different individuals through a systematically organised programme of education. However, one thing remains there that each child cannot be turned into a highly creative

person still then he can develop to the extent that he atleast thinks creatively and uses his creativeness in one field or another to satisfy his needs. Researchers have observed that the children who have been given training to think creatively do a job in a better way than those who have not been given such a training. It has also been seen that in the long run the children lose this ability due to lack of proper guidance from their teachers as well as parents.

A considerable amount of research has been done in recent years to determine ways and means of developing creativity among school children. On the question whether creativity can, in fact be fostered through environmental manipulation; researchers generally agree that education can do a great deal in promoting creative performance, if perhaps not in producing the creative abilities themselves.

The environmental conditions which are related to creativity are those which encourage and facilitate openness in thought and action, and provide for discovery of new ideas. While discussing the conditions of creativity : Rogers (1954) has emphasized "the psychological safety and freedom" which foster constructive creativity. According to him, this can be established by accepting the individual as of unconditional worth, providing a climate in which external evaluation is absent, and understanding the pupil empathetically which would, in turn, enable the pupil to feel free and allows his real self to emerge and express himself in varied and novel formings. Torrance (1952a) in his crosscultural studies has shown that several cultures and subcultures impede the growth of creativity through subtle, consistent pressure for conformity. Parnes (1963) also has pointed out that there is a consensus that productivity can be developed through deliberate procedures.

Torrance (1962) in his cross-sectional studies has indicated that creative development is discontinuous and that children experience great difficulty in maintaining their creativity. The most severe discontinuities seem to appear at about ages 6-6, 9- 10, and 12-13 years. These discontinuities seem to be culture- made rather genetic. Studies in the mid-1960's, nevertheless, indicated that certain planned curricular changes are powerful enough to avert even the sharp drop in creative functioning that occurs in the fourth grade (Torrance and Gupta, 1964). The sufficient empirical evidence available in literature

suggest that teaching in specific ways stimulate and develop creative problem solving skills in students.

### **Problem-Solving**

Research on problem solving has had a varied history. Before the 1930's, most text-books still treated logic in considerable detail, making it the basis for intelligent or rational behaviour. This was quite natural, since psychology was an offshoot of the philosophy of mind. Later text books carried chapters on thinking, and questions of consciousness, imageless thought, associative "set" and concept formation were the subject-matter of research in thinking (Woodworth, 1938).

Perhaps the greatest impetus to research in problem solving came from studies of animals seeking to investigate into the rationality. History reveals that philosophers had attributed reason and soul to man alone. Thorndike (1899) initiated an experimental approach to the analysis of problem-solving behaviour by developing the problem box and observing how cats found their way to food. This led to a whole series of problem-box investigations, and Watson described problem-box mastery as the development of motor habits and grouped it with maze learning. The problem-solving became classified with learning. The method used in the problem-solving has been referred to as trial and error.

Various types of puzzles have been used to study human problem solving, as a result, trial and error has become a generally accepted mechanism. Dewey (1913) used the concept to account for human problem-solving by describing a process he called mental trial and error. In this way, the problem-solving capacity of the trial-and-error process was expanded. At the same time, it gave man a kind of superiority over animals in that he could eliminate incorrect alternatives without trying them out behaviourally.

It was only after World War II when research funds for investigations of creativity and originality were made available, a new name for a higher type of problem-solving was accepted, the implication being that creativity included more than learning and intelligence. Although it had long been recognised that intelligence and

problem-solving ability had a limited relationship, the recent research had revived the importance of distinguishing between intelligence (the ability to learn) and creativity. The work of Getzels and Jackson (1962, and Torrance (1965) reveal this trend, which lays emphasis on unusual, innovative types of personality. This, of course, is required when an individual is faced with a new situation that poses a problem. A problem becomes difficult when its solution requires responses that deviate from the common ones or from previously learned ones. Approached in this way, it follows that the creative persons should be a good problem solver because he can solve not only routine problems but all those that require more than a learning mechanism.

Problem-solving methods being used are often classified as "traditional" and "new". Traditional methods are more rational and logical whileas the new methods attempt to train the individual through freeing him from his emotional inhibitions. Generally problem-solving method involves the following steps :

1. *Definition of the problem* : It involves definition of the initial problem as well as establishment of the problem.
2. *Searching for methods* : It involves searching for different methods, evaluating them and finally selection of the suitable method takes place.
3. *Preparation of the design* : In it an outline of the design is prepared, test is conducted and evaluation is done.
4. *Results and solution* : It involves generalizing the results and arriving at the best solution.

There are different techniques of creative problem-solving such as, attribute listing, brainstorming, inquiry training and synectics. These techniques facilitate solutions that are creative, i.e. solutions characterised by freshness, appropriateness, imagination, new realtionships between even common place facts or ideas, and significant transformation of the initial definition of the problem.

### **Attribute Listing**

This technique was developed by Robert Platt Crawford (1954).



This is a useful technique for designing or re-designing a specific product or activity or service. According to Crawford, magic inspiration is not the only, or even major source of creativity. Much creativity arises from changing the attribute of an object or an activity, or from grafting on to the object or an activity, an attribute or attributes of some other object or activity. For example, many years back travelling bags used to be made of metal to ensure durability, today durability is ensured by making much lighter plastic substitutes.

In 'attribute listing, 'the attempt first is made to list the basic but modifiable attributes or properties or specifications of a particular object or activity. Then an attempt is made to search for alternatives to the present attribute. As an example of "attribute listing" can be seen in the search for a better method of cutting cheese. At first, the initial problem is how to develop a better knife; this problem leads to another problem, i.e. how to arrange attributes of a better wedge are listed; also the undesirable attributes are listed that are to be eliminated. Finally, if any other problem arises, its attributes both desirable as well as undesirable are listed, the undesirable are to be eliminated to arrive at the best possible solution.

Attribute listing is a very powerful technique for improving product design. The list of the modifiable attributes of a product-be it a commercial product, or a service, or even some activity often leads to suggestions for improvement. So long as one thinks of a comb, without thinking of various properties of a comb, he is not likely to come up with better ideas about improving its design, easy to keep, easy to clean, durable, sharp enough to massage the Scalp but not to hurt it, easy to handle attractive in appearance, Cheap, etc., a large number of alternative designs, colours, materials, manufacturing processes, and so on, may come to mind. In this way, the generation of more ideas will lead to the improvement of the product design.

In attribute listing, it may very often be useful to list abstract attributes of a concrete object or activity. This may help in generating more ideas than if the concrete attributes are listed. For example, if one wants to seek for ideas for redesigning a cup, it may be better to conceive it as a container than as a tea cup, for thinking of the cup as a container makes possible designs that enable the use of a cup not only

for drinking tea but also a variety of other fluids, and not only for drinking from but also to eat from, use as a flower vase, cook in. etc. Similarly, it may be better to consider handling convenience as an attribute rather than the cup as having a handle to hold it. Next, seeking what function a current attribute serves, and then looking for alternative ways of meeting the function is a way of thinking about the abstract properties or attributes of an object or activity.

Crawford has laid down the following principles of attribute listing :

1. Creation is not inspiration alone—it is largely adaptation and experimentation.
2. Creation is not just mechanically combining different ideas rather it is useful modification of an attribute, or assimilation of attributes of other objects.
3. Creation is not simple stealing of ideas; it is continuing array of modifications suggested by ideas in use which result over time into greatly changed objects or products like the thousands of modifications incorporated into the automobile over the years.
4. It is desirable to search for concrete alternatives during the process of modifying the current attributes of an object. For example, if one is seeking to change hard railway seats, he should think not of just soft seats, but seats with the softness of a pillow or foam or vinyl.
5. Creativity can be systematised by looking first for closely related substitutes of the current attributes and then progressively going in for more and more far out alternatives.

It is important to note that the attribute listing would give better results when the object or activity one wishes to change is more specific; when the modifiable attributes are separated from the un-modifiable attributes of the objects in order to concentrate one's attention on the modifiable attributes. Some important points that need to be considered in 'attribute listing' are explained briefly as under :

- (i) First, to list exhaustively all the obvious attributes of an

object or activity such as, the present size, colour, shape, function, weight, major components, material etc. for an object; and present duration, function, steps, sub-programmes, etc. for an activity.

- (ii) Second, to identify some of the attributes that can possibly be changed without destroying the main function of the object or activity.
- (iii) Third, the changeable attributes may be stated in more abstract terms. Thinking what functions these attributes perform and how critical these functions are to the main use of the object or activity would not only help in listing necessary attributes in abstract terms, but also help one in fixing priorities of attributes and in encouraging one to look for alternative ways of satisfying functional requirements.

### **Morphological Analysis**

Morphological analysis is a variant of attribute listing. This technique was developed by Fred Zincky in California (1957). It facilitates the imagination by enabling the individual to focus on one aspect of the object or activity at one time. It involves combining the modifiable attributes of the major variables of problem into a grid so that all possible combinations can be considered. The first task relates the identification of the major variables; next, the attributes of the major variables are listed; and finally, the possible combinations of the attributes are considered so as to generate a large number of ideas. Similarly; also other aspects of the problem are analyzed in regard to its attributes and possible combinations which ultimately lead towards the best possible solution of the problem in question. For example, if the problem may be how to fabricate a new type of building material, first of all, the identification of attributes of the material is done, followed by possible techniques of binding the material; and finally, methods of fabricating are plotted into a grid which may extend to any number of possible combinations.

In morphological analysis, the basic idea is to identify the critical modifiable attributes, and listing several alternatives for each of the

attributes enables one to generate a very large number of alternatives of an object or an activity. As an example, consider dissemination of daily news. The alternatives for the attribute of medium of disseminating daily news can be done by newspapers, radio, television, fax, telephone, or direct briefing. The second attribute can be frequency—once a day, twice a day, thrice a day and so on. The third attribute can be of coverage, i.e. local, regional, national, international. The fourth attribute can be of content, i.e. Economic, Social, Political, Scientific, cultural. In this way, one can list these under 'four' headings wherein six 'medium alternatives' are listed under one heading; 'three frequency alternatives' are listed under the second heading; 'four coverage alternatives' are listed under the third heading, and 'five content' are listed under the fourth heading, thus totalling  $6 \times 3 \times 4 \times 5 = 360$  alternatives through which the daily news can be disseminated.

Arnold has pointed out that there is one basic difference between "attribute" "listing" and "morphological analysis" that the "attribute listing" works best when the object, activity, product sought to be modified is very specific such as 'this chair' rather than 'chair' in general. On the other hand, "morphological analysis" can also be applied profitably to modify general objects or activities, such as air transportation, health care or political machinery etc.

"Attribute Listing" and "morphological analysis" are not technique merely, they embody important values and attitudes favouring to creativity. The chief such value is one of trying out a new combination which fosters experimental; innovative bent of mind and also alerts one to possible new application of ideas.

### **Brain Storming**

Brainstorming is a popular method of group thinking. Alex Osborn established the 'Creative Education Foundation' at the University of Buffalo in 1957, it is here he developed the method of brainstorming. This method is widely used by businessmen, scientists and others to tap the tremendous source of creative power. It is a technique with which problem is attacked from all possible angles to generate a large number of ideas in order to arrive at the best solution.

Brainstorming has been widely used in American Government and Industry; Osborn, the father of brainstorming, has cited several examples. In one brainstorming session in a federal government officers' conference, the group brainstormed on "what can federal employees do to give visitors to Washington a truer and better impression of their government? Within 30 minutes, 121 ideas were elicited. In another brainstorming session, some U.S. Treasury personnel produced 103 ideas in 40 minutes on "How can we get more federal employees to sell more U.S. saving bonds?" In yet another brainstorming session, the group brainstormed on "How to reduce absenteeism?" they produced 89 ideas in 30 minutes, and on "How to free bond-selling employees from office duties?" they produced 61 ideas in 30 minutes. In a telephone company, a brainstorming panel brought out over 100 new ways to recruit employees.

In a brainstorming session, a group of people sit around a table to brainstorm a specific problem. Each participant presents the ideas which come to his mind. No member of the group is allowed any criticism on the idea put forward by another member. The objective underlying this is that of freeing a person from the usual inhibitions that operate to block his creative process.

*Principle* : The main principles of brainstorming are :

1. Deferring evaluation during the idea production phase, especially evaluation of a negative, critical kind. This means that the participants must withhold adverse judgement of ideas put forward by other members of the group.
2. Free wheeling of ideas should be encouraged rather welcomed. The participants must cheerfully accept even wild, silly and crazy ideas put forward by other members. The more fantastic the ideas, the better. A fantastic idea can be one that does not seem at all a practical idea but still then it serves the important function of going off the beaten track, i.e. thinking divergently instead of conventional patterns of thinking. While the idea itself may not be practicable, somehow it may hit upon other ideas that might not only be novel but also useful.

3. *Quantity begets quality* : The more the ideas are generated, the higher will be the probability of hitting upon some brilliant ones. participants must express ideas whatever come to their mind readily and spontaneously. The objective underlying this is that of generating more and more ideas, i.e. first quantity and then it would lead to quality.
4. Hitch-hiking on previously expressed ideas. Participants should aim at building upon and improving each other's suggestions. Besides contributing their own ideas, the participants should suggest how ideas of others can be turned into better ideas or how different ideas can be joined together into new possible combinations to form new ideas. Moreover, no participant should feel ashamed of in building on others' ideas or one's own previous ideas. This simply means one should be open to the suggestive power of others or one's own earlier ideas.
5. In one session, one aspect of the problem should be brainstormed so that a large number of ideas are collected.

In view of the usefulness and practicability of brainstorming, educationists, teachers, and students as well can use this technique very successfully to find out the best solutions to the problems that are faced by the existing system of education. For example, in the classroom it can be used to promote discipline, teaching-learning process; check delinquency, truancy, dropout tendency of pupils; causes as well as preventive measures can be identified in regard to student unrest and copying in the examinations. This technique can be of a great help to the teachers in developing problem-solving attitude among pupils and also in stimulating their imaginative and creative powers. This is possible only when the teachers or others who wish to use brainstorming are fully abreast with its inherent potential.

1. Brainstorming is not useful as a technique where the problem has a such solution that can be reached by analysis. For instance, if the problem may be to find the square root of 5 thousand, there is no need of brainstorming whileas; it is particularly useful for problems that can have multiple solutions, of which some may be better than others, such as,

"how one can make a child more interested in studies".

2. brainstorming gives fruitful results when the topic selected for brainstorming is specific. If the topic is vague, the brainstorming will carry different frames of reference and the ideas generated will have a diffused applicability. For instance, if the topic may be "how to get ahead in life" is not clear. Different people will take different meanings out of it. No doubt, it may generate many ideas, but since what it means to different people "to get ahead" is not clear, the ideas generated are likely to be too disparate. On the other hand, if the topic may be "how to get promoted in a particular organisation" is likely to yield more useful and pertinent solutions.
3. During the brainstorming session, the leader should encourage the members to provide concrete suggestions or ideas instead of abstractions. These abstractions sometimes become not only difficult but also impossible to turn into practice. Sometimes members also provide such suggestions which are mere good intentions, also become difficult to put them to actual use. The members should, therefore be advised and encouraged to concretise their ideas. The concrete ideas stimulate hitchhiking and action orientation. They have an energy charge that abstraction lack. It is better that the ideas expressed should be concise, brief, clear and specific.
4. In order to select the most useful ideas among the host of generated ideas, it is necessary to identify a few ideas for more intensive investigation. One useful technique can be to have each member of a panel vote on the potential of each idea for solving the problem at hand or the ideas can be grouped into classes and then each idea within a group may be voted upon. Better it would be to formalise the criteria first for assessing the potential of the ideas generated before the ideas are voted upon.

If the ideas initially generated are large, voting may have to be done more than once. That is to say, ideas voted the best in the initial

round of voting may again be put to a vote to get a small number of high potential ideas. These ideas may then be taken up for much more intense scrutiny. In this way, high potential ideas are selected and put to use.

The research of Sidney Parnes (1959) indicates the positive effects of "brainstorming". His research also provides evidence that creative productivity can be developed by deliberate procedures. He studied the development of creative behaviour by devising several courses for the students of various streams. While evaluating the problem-solving course he demonstrated that the students who completed the creative problem-solving course performed significantly better on six out of eight tests of creative thinking than did comparable students who had not taken the course. His second observation was that increased productivity in creative thinking produced by the creative problem solving course persists for a period of eight months or more after the completion of the course.

His research also provides evidence that individuals working alone often accumulate more and better ideas than they do when working in a group. On the basis of research findings he points out certain points that need to be considered in the conduct of brainstorming sessions :

1. The first of these is the principle of deferred judgement—deliberately deferring judgement during the idea-production phase.
2. Avoiding critical analysis of the idea after a quantity of alternatives is listed.
3. *Extended effort in idea production* : Extended effort in idea production will lead to an increasing proportion of good ideas with increased production. Since brainstormers are able to generate more (quantity) and quality ideas in the second half than in the first half of the brainstorming session, Parnes suggests that the session should be broken into two halves. By doing so, brainstormers learn from the experiences of the first session and also are stimulated by each others' ideas. Thus, extended effort results in the production of new and



better ideas than the earlier ones.

To conclude, brainstorming facilitates the development of divergent thinking abilities in human beings in more than one way. In a brainstorming session, people drop their defensiveness, and instead of competing for power and status, they compete for excellence and reativeness of their ideas, second, brainstorming reinforces a sense of participation especially if brainstorming is followed by voting on the best ideas. As is well-known, participation increases commitment to implement the participatively chosen course of action. Third, brainstorming increases self confidence and sense of resourcefulness. The host of ideas it produces provides a clear demonstration of the power of the human mind to overcome obstacles.

### **Inquiry Training**

Inquiry training model was developed by Richard Suchman (1962) to teach students a process for investigating and explaining unusual phenomena. The main objective underlying the model was that the scientific process skills are developed in the pupils to enable them to organise data, reason about cause-and-effect, and build and test theories. He modelled the model along the lines of the methods employed by creative researchers especially physical scientists. He identified the components of the inquiry process and built them into the instructional model to which he called inquiry training.

Suchman bases his inquiry training approach on the four postulates. First, the children are curious and eager to grow by nature. He emphasizes that when children are faced with a puzzling situation they naturally get motivated to explore the data surrounding the discrepant event and think of arranging the data in new ways to find answers to the problem. The general goal of inquiry training is to help students develop the intellectual discipline and skills necessary to raise questions and search out answers stemming from their curiosity. Second, the process of inquiry can be taught to students. Suchman believes that students can become increasingly conscious of their process of inquiry, and that they can be taught scientific procedures directly. He emphasizes that we cannot analyze and improve our thinking unless we are conscious of it. Third, team approach is more

useful than the individual approach to find solution to a problem. Suchman believes that the view point of a second person enriches our thinking; and that it is the cooperative inquiry that leads to the development of new knowledge. Fourth, all knowledge is tentative, suchman emphasizes that the students should be made aware of the fact that all knowledge is tentative. Scholars constantly generate theories and explanations. After sometime, these theories are replaced by new ones, which conveys that there are no permanent answers to problems; new and sophisticated ways are investigated to reach the solution of the problem, or new ways are detected to look at the problem itself.

### **Inquiry Training Process**

In "inquiry training", the students are presented with a problem situation such as, an episode, experiment, story, etc. and are asked to inquire into it. In whatsoever form it is presented, it must essentially carry a discrepancy leading to a puzzle. Since the ultimate goal is to have students experience the creation of new knowledge, the confrontation should be based on discoverable ideas.

After the presentation of a puzzling situation, the students are encouraged to ask question. These questions have to be worded in the way that they are answered by a yes or a no. The students may not ask the teacher to explain the phenomenon to them, however, they can ask question that are responded by the teacher only in a yes or a no. Whenever a question cannot be replied in a yes or no response, the teacher reminds of the rules, and waits until they find a way of rephrasing the question in proper form. Comments such as, "can you restate this question so that I can answer it with a yes or a no?" are common teacher responses when student slip out of the inquiry mode.

Thus, at the first stage of the inquiry process, the students are taught to verify the facts of the situation, i.e., the nature and identity of the objects, the events, and the conditions surrounding the puzzling event. As the students become aware of the facts, they form hypotheses which guide them in their future inquiry. Using their knowledge about the behaviour of objects, students can turn their questions to the variables in the situation. This they can do by conducting verbal or acutal experiments to test these causal relationships, selecting new

data, or organising the existing data in new ways to see what will happen if things are done differently. It may not be possible for the students to frame proper questions to test the causal relationships between variables unless they have sufficient information about the nature of the problem situation and its elements, and it is likely that they are to be overwhelmed by the many possible causal relationships.

Finally, the students try to develop hypotheses that will fully explain what happened. In other words, it means that they reach the final explanation, however, they need to be cautioned that there can be many possible explanations, therefore they should not be satisfied with the first explanation that appears to fit the facts.

The main emphasis in this approach is on becoming aware of and mastering the inquiry process and not the content of any particular problem situation. The teacher also need not be too concerned with subject matter coverage or "obtaining the right answer" for the reason that it would violate the real spirit of scientific inquiry, which emphasizes team approach of searching together for more accurate and powerful explanations for everyday phenomena.

### **Phases in Inquiry Training**

There are five phases (steps) in the inquiry training process. The first phase is the student's confrontation with the puzzling situation. The second and third phases concern with the data gathering mechanisms of verification and experimentation. In the fourth phase, students organise the data and try to explain the discrepancy. Finally, in the fifth phase, the students reflect on the problem-solving strategies they used during the inquiry.

#### **Phase I : Encounter with the Problem**

In this phase, the teacher is required to present the problem situation and explain the inquiry procedures to the students. The teacher is required to satisfy himself that the students have understood the inquiry procedure (pattern of the yes-no question) and also the objectives fully. Then he can present problem situation to the students which should essentially carry a discrepancy. The problem to be posed

should be simple such as, a puzzle, riddle, or magic trick that does not require much back-ground knowledge. However, every puzzling situation cannot be a discrepant event. It is, therefore, important to note that the distinguishing feature of the discrepancy events is that it involves illogical phenomena that conflicts with the notions of reality. A problem may be puzzling simply because we do not know the answer, but simultaneously we do not need new concepts to understand it and therefore we do not need to conduct an inquiry. Thus, the problem to be taken for inquiry should essentially accompany a discrepancy but care needs to be taken that it matches with the cognitive level of the students.

### **Phase II : Data Gathering-Verification**

In this phase, students gather information about the problem in hand through observation or experience. They are required to ask questions about objects, properties, conditions, and events in order to verify the information. Objects refer to determining the nature or identifying of objects. Properties refer to verifying the behaviour of objects under certain conditions. Conditions refer to the state of objects at a particular time, and events are related to verifying the occurrence of an action. Wherever students deviate from verifying all the aspects of the problem, the teacher reminds them of the rules of the process and makes them aware of the type of information they are likely to seek and put them to work to change the questioning pattern.

### **Phase III : Data-Gathering-Experimentation**

In this phase, students introduce new elements into the situation to see if the event happens differently. Exploration serves two functions, that is, exploration and direct testing. Exploration refers to changing things in order to see what will happen though it is not necessarily guided by a theory or hypothesis, but it may suggest ideas for a theory. Direct testing refers trying out a theory or hypothesis. The hypothesis determines the direction of data gathering. If the data gathered support the hypothesis, it is retained as part of the explanation. If the gathered data do not support the hypothesis it is rejected and consequently alternate hypotheses are formulated and the process is

repeated.

Although verification and experimentation are described as separate phases of the inquiry training approach, yet the students' questions usually alternate between these two phases of data gathering. The teacher, thus, needs not to be very rigid in following these two phases separately instead he should encourage students to generate questions that pertain to data gathering and consequently lead them to formulate the explanation.

#### **Phase IV : Formulating an Explanation**

In this phase, the teacher calls on the students to formulate an explanation. It is possible that different students may put forward different explanations, however, some students may have difficulty in making the intellectual leap between the data they have gathered and a clear explanation. It is also possible that they may give inadequate explanations omitting essential details. It has been experienced that sometimes several theories or explanations are possible based on the same information. In view of this, it is useful to ask all the students to state their explanations so that the range of differences is revealed. It is believed that the group together can shape the explanation that fully responds the problem situation.

#### **Phase V : Analysis of the inquiry process**

In this phase, the students are asked to analyse their pattern of inquiry. This would help them in finding out the questions that were most effective; the lines of questioning that were most productive and those that were not; or the type of information they needed but couldn't obtain. The teacher asks students to recall the question they have raised and to identify those questions that led them to explanation but not others. In this way, the teacher goes on repeating the whole process of inquiry so as to make students aware about the pattern of questions needed to be raised during the phases of verification and experimentation that have helped them to reach at final explanation and also making the inquiry process a conscious one so that steps are systematically taken to improve it.

Inquiry training approach promotes active, autonomous learning as the students themselves formulate question and test ideas. It calls upon students to take courage to ask questions, and helps them to become more proficient in verbal expression as well as in listening to others and remembering what has been said. The chief learning outcomes of this approach are the involvement of varied processes such as, observing, collecting and organising data, identifying and controlling variables, framing and testing hypotheses, formulating explanations and drawing inferences. The magnificent integration of these several process skills into a single, meaningful unit of experience is the chief characteristic of this approach.

This all depends when both the students and teacher try for their balanced roles that the teacher selects the problem situation in accordance with the students' cognitive level; acts as a referee throughout the inquiry process; responds warmly to students' questions; brings them back on the right track if they deviate; facilitate discussion and interaction among students; and finally helping them to arrive at explanations; and that the students on the other, actively participate in finding out the discrepancy from the problem; raising pinpointed questions; process data in a systematic sequence; tolerating ambiguity; and formulating explanations.

### **Synectics**

The word 'Synectics' has been adapted from the Greek word 'Synecticos' meaning fitting together diverse elements. Synectics is based on the use of metaphors and analogies within a systematic framework to achieve creative results. It is central to synectics that better understanding of a problem is attained when it is strange or unfamiliar and allows us to think of an analogy or metaphor that makes it more familiar and hence more amenable to a creative solution. In synectics, then the problem as one is presented with, it initially has to be restated and looked at in various ways through the use of metaphors or analogies. During the course of this process, the individual goes on what synectics people call an "excursion" and as a result of such a trip creative solutions are attained.

Initial work with synectics procedures began about 1944 when

William J.J. Gordon undertook an intensive study of individual and group processes in creativity. This was followed with a systematic exploration of his ideas in 1948 with a group of artists and then went on forming synectics groups in several companies. Finally, he and his associates designed this new approach "synectics" for the development of creativity at Cambridge, Massachusetts in 1961.

Gordon and his associates believe that the group process in creativity is analogous to the individual process; that the creative process can be understood, described and taught; and that individuals can increase their creativity if they understand and use the process. He also believes that creativity in the arts is analogous to creativity in the sciences, and that emotional and intellectual, rational and non-rational components are involved in creativity.

In synectics, non-rational processes are engaged through the purposeful use of metaphors. Since many researchers have attempted to define the roles of the preconscious and unconscious in the creative process, the credit goes to synectics people who have so systematically tried to engage these sources of creativeness. What they have sought out to do is to imitate the processes of incubation in the preconscious mind as incubation is thought to be the phase of problem solving in which the preconscious mind is working out the solution a complex problem without the conscious and being aware of this. The preconscious mind does not think logically; it thinks analogically, associatively, visually. However, rational and logical processes are also used in synectics. They too are valued, encouraged, and enhanced in a group situation that is free, easy-going, and accepting. Moreover, regardless of the emphasis placed on non-rational factors, the whole synectics process occurs within a framework that has very practical goals.

Among the various factors that play important roles in synectics are five psychological states involved in the creative process. The five psychological states are :

1. *Involvement and detachment* : This state refers to the relationship between the individual and the problem on which he is working. Involvement refers to understanding and interacting with the components of the problem. Detachment refers to the detaching from and becoming distant from the problem. By this we mean that the

creative process involves both the capacity of involvement of the individual with the problem on the one hand and getting detached from the problem on the other in order to view it objectively.

2. *Deferment* : Experience has shown that quick and immediate solutions to a problem are likely to be premature and superficial. They should, therefore, be deferred until best solutions are arrived at. Deferment refers to the capacity of both the individual and the group to defer these quick solutions until they have arrived at the best one.

3. *Speculation* : Speculation refers to the type of thinking in which individuals are able to let their minds run free so that they can come up with ideas, hypotheses and solutions.

4. *Autonomy of object* : As the creative process proceeds and a solution is approached, there is a feeling that the solution has an entity and demand quality of its own. The individual or group must be willing and free enough to allow this feeling to develop and to follow it.

5. *Hedonic response* : Synectics involves among other factors. play with "apparent irrelevancies", to generate energy for problem solving and to evoke new views of problems. One of irrelevancies is an emotional factor referred to as "hedonic response" which serves as an 'irrelevance filter'. The feeling involved in the hedonic response is very subtle and is similar to the inspiration or intuition that is sensed prior to arriving at the solution to a problem (Gordon, 1971). It is the pleasurable sensation that accompanies the feeling of being right about a hypothesis or a solution before it has been proven correct. There are both aesthetic and pleasurable elements in hedonic response. It is of great importance, if an individual could learn how to recognise it, then he would probably not waste so much of time and energy in the creative process; the individual would have that "feeling" aesthetic or otherwise that would tell him when to follow up a hypothesis and when to pursue a tentative idea to solution.

### **Operational Mechanisms**

The psychological states are induced by operational mechanisms. The individual who is working on a problem actually utilizes these operational mechanisms. If they operate effectively, then the



psychological states function very quietly and "take care of themselves". One of the functions of these mechanisms is to make the familiar strange. In doing so, one of the important psychological functions that is accomplished is to increase the distance enables the individual to avoid becoming stuck with what he already knows about a problem and being limited to it. The four such mechanisms are :

1. *Personal analogy* : Here the individual attempts to imagine himself to be the object with which he is working. Gordon (1971) believes that the critical elements in personal analogy is empathic identification : that the person is asked to retain his individual human sensibility but is simultaneously asked to transpose himself into a situation and to report what he feels, sees, hears, thinks, etc. For Instance, if the discussion is about static in the radio, the leader may ask group members to imagine themselves to be a radio and to tell the group what they see, feel, think, etc.

There are four levels of involvement in personal analogy. (i) The first person description of facts : It involves a mere statement or listing of facts. (ii) The first person description of emotions : It represents the lowest order of identification. These two levels are considered the owest level analogies. (iii) Empathic identification with a living thing : Since it represents both Kinesthetic and emotional involvement with object is regarded as 'true' personal analogy. (iv) Empathic identification with a non-living object : This is the most aophtisticated type of empathy as it is much more difficult to attribute human emotions with non-living objects. On the other hand, it may be easy to do so with living objects as in the case of level.

2. *Direct analogy or example* : In this facts, knowledge, or technology from field are used in another field. Direct analogy involves seeking a direct comparison of the phenomenon under discussion with some other phenomenon that is similar enough. For example, if aerodynamics of a plane are under discussion, the group may think of and explore how birds marage to fly into a plane's aerodynamics. For many problems, the synectics people have found analogies from biology particularly useful in generating fruitful insights, however, whatever other information an individual has at his disposal may be helpful to him in direct analogy.

The more far fetched the analogy, the greater the probability that the angle suggested by the analogy has not previously been thought of by any body. Gordon (1971) says that analogies with small psychological distance from the problem can be effective for problems being worked on for the first time; but for problems that have been worked one great deal, analogies that reflect great psychological distance—those that are rather remote from the individual's experience—are required.

Direct analogy is the basic mechanism by which an individual tries to see problems in new contexts. A direct analogy is clear and straight forward. It produces immediate results and its process can be reproduced (Gordon, 1971).

3. *Symbolic analogy* : The symbolic analogy is also called book title, essential paradox, and compressed conflict. This form of analogy makes use of objective and impersonal images to describe the problem. An individual effectively uses symbolic analogy in terms of poetic response; he summons up an image which, though technologically inaccurate, is aesthetically satisfying.

The function of "book title" is to generalize about some specific matter and to use the generalization to suggest a direct analogy. This helps people who stay close to the problem to get away from it. In a "book title" there is both essence of and a paradox involved in a particular set of feeling (Prince, 1970).

4. *Fantasy analogy* : Fantasy analogy is based on Freud's idea that creative work represents wish fulfillment. The individual states a problem in terms of how he wishes the world would be. In it, the group members are urged to imagine a constraint-free solution in much the same way as our wish-fulfilling day dreams. Group members are asked to fantasize some perfect solution even if it flies in the face of known scientific principles. Gordon regards fantasy analogy as an excellent bridge between problem stating and problem solving because it also tends to evoke the use of the other mechanisms.

Thus, synectics in the course of problem solving situations, attempts to make the familiar strange and to make the strange familiar through the use of the different types of analogies. These analoges

enable the individual to look at problems in new ways, and thereby hope fully gain new insights into the problems.

Synectics also attempts to make conscious what goes on in the unconscious by means of operational mechanisms. The psychological states are also induced by these mechanisms. These states create the psychological climate necessary for creative activity.

### **Steps in Synectics Process**

The main steps involved in the synectics process as proposed by Gordon are briefly discussed as under :

1. *Problem as given (PAG)* : The problem may be posed by an outside source or by an individual in the group and may be explained to the group by an expert.

2. *Short analysis of the PAG* : At this stage, the expert starts by explaining the problem in sufficient detail that the group has a common understanding. Since the expert is also a participant, he does not need to reveal all the minute details of the problem which can come out later during the session. In order to understand the problem, and to unravel the hidden elements, the group members attempt at making the strange familiar.

3. *Purge — Immediate suggestions* : At this stage, individuals participating in the process are likely to think of and present varied suggestions or solutions. Such suggestions are not likely to be perfect solutions; however, they should be verbalized. The leader should urge group members to rid themselves of the superficial ideas and attempt at turning to more innovative possibilities.

4. *Problem as Understood (PAU)* : If the problem remains unsolved, the leader asks the members of the group to state the problem as they understand it, this is called the "problem as Understood" phase. The group member may either state the problem as he sees it, i.e. a simple paraphrase of the actual problem, or he may state in any other manner as he thinks desirable not worrying whether it is realistic or not. The leader then asks the group members to put the problem out of their minds and to concentrate on what he asks. Essentially, he now starts to take the group on a mental excursion.

5. *Excursion* : It is at this stage that an extended process of the problem-solving starts. According to prince, this stage is like taking an artificial vacation or a holiday from the problem in which the participants are asked to put the problem out of their minds. He is aware that if they are capable to do so, they will put it out of their conscious minds but still shall continue to work on it in their preconscious minds.

It is during this stage of the synectics process that the different operational mechanisms and the different kinds of analogies are used. Essentially, it is at this stage that the group tries to make the familiar strange. The leader questions the members and attempts at evolving responses to his requests for different kinds of analogies.

Next, the leader may ask an evocative question ; such as, an example from some other field, of an aspect of the chosen problem as understood. For instance, an evocative question may be "can you think of a crowded situation from biology?" Here the leader is asking for what is called a direct analogy. A number of responses may be made to the evocative question "flies on cow dung" "Virus culture" "drop of sperm" etc. could, for example, be such responses to the above said evocative question concerning a crowded situation.

At the appropriate time, the leader may request for a personal analogy. For instance, he may take up "virus culture" and ask each group member to imagine himself as virus in a virus culture. He may ask them to explain how it feels to be a virus in this culture. Group members may come forward with different types of responses.

The leader may also ask group members to fantasize (without reservations) about how one could, as a virus set out to conquer the world. This kind of analogy is referred to as fantasy analogy.

Then, the leader may ask for a symbolic analogy (book title)—to give book title comprised of two or three words, poetic or otherwise, that captures the essence of a key word such as virus culture and contains a paradox. The participants may respond with different types of titles.

6. *Force fit* : This involves two stages i.e. (i) Fantasy force fit, (ii) practical force fit. According to Gordon an attempt is now made to force a fit between the analogy and the problem as understood. In forcing a fit a very obvious attempt is made to make effective use of the last

analogy to solve the problem. Gordon calls this stage fantasy force fit because fantasy provides the individual with greater license and freedom for response.

During this stage, if the leader senses that a potentially useful approach to the original problem is at hand, he may ask for a force fit, i.e. he may ask the group members to try to think how the present idea or analogy could suggest a solution to the original problem. The next step is then to come up with a practical application of the analogy to the problem i.e. practical force fit.

7. *View point.* The problem solving process ends either in a viewpoint that could be used for the solution, or in a new problem as understood, and the recycling of the process takes place again.

Prince emphasises that a viewpoint remains a possibility until leads to a possible solution are developed. He uses the word possibility instead of viewpoint because every viewpoint is regarded so until it has been implemented and found workable. It is the implementation stage which is too difficult and a solution that actually works may be several times removed from anyone viewpoint. The objectivity of any viewpoint is judged by the new elements it does have and should be promising one. Thus, it is finally the viewpoint which leads to arrive at a solution of the problem at hand.

### **Implications for Education**

Gordon bases synectics on four postulates that challenge conventional views about creativity. First, creativity is important in everyday activities. Mostly the people associate the creative process with the development of great works of art or music, or with some new invention. Gordon creativity as a part of our daily work and leisure lives. Second, the creative process is not at all mysterious, it can be described, and it is possible to train persons directly to increase their creativity. Traditionally, people view creativity as a mysterious, innate, and personal capacity that can be destroyed if its processes are probed too deeply. In contrast, Gordon believes that if individuals understand the basis of the creative process, they can learn to use that understanding to increase their creativity and that they can use in their

everyday activities. This view led Gordon to create training procedures that can be conducted in schools and other settings. Third, creative invention is similar in all fields—the arts, the sciences and is characterized by the same underlying intellectual processes. The fourth point Gordon emphasised that individual and group invention are very similar is again contrary to the viewpoint that creativity is an intensely personal experience.

Gordon believes that the learning process is very similar to the creative process. Consequently the following points have served as background rationale for him to use synectics in education :

- (1) Knowledge of psychological processes by which people learn will help them increase their learning efficiency.
- (2) Emotional components and intellectual components, rational and non-rational components, are all equally important in the learning process.
- (3) For successful learning, the emotional and non-rational elements must be directly involved in the learning process.

Synectics has so far been used in many schools. Various programmes that have used synectics include several mathematics, sciences, visual arts, general education, and abnormal psychology courses. Varied teaching material and techniques have been developed to make the use of synectics more effective in school situations. One of these is a workbook entitled "The art of the possible" which is meant for the junior high school level in the area of social studies. It deals with cultural inventions and individual inventions to foster creative thinking among students. Another developed text is "invent-o-Rama" for use in the area of invention. The exercises in this text are designed so to help the students develop the attitude that all problems are solvable. This text includes two forms of inquiry i.e. problem-solving inquiry, and substantive inquiry. Problem-solving inquiry aims at helping the students to learn a problem-solving technique that will give them increased confidence in going beyond what they have available. In the substantive inquiry, the students learn how to make the strange familiar and familiar strange.

Some of the educational situations where synectics approach has

been used and the effects that have been obtained, as reported by Gordon (1971) are as under :

Richard Hindley, Dean faculty of Franconia college has used Gordon's approach with his general education courses and revealed that as a result of synectics, the unmotivated students in his class became more motivated, found learning to be fun, and had a widened scope of understanding. Apparently, the students became more motivated because there was greater emphasis on their own experiences and contributions.

The synectics approach has also been tried with both over achievers and underachievers in school. It has been reported that underachievers have shown the most improvement. To account for this improvement, Gordon assumes that the metaphorical approach demands that the teacher listen to the students, which implicitly denotes the teacher's respect for the student and care for their ideas, feelings and experiences.

While making an evaluation of educational use of the synectics approach it was reported that there was a significant change in the two factors of creativity i.e. originality and elaboration while as rest of the factors i.e. fluency and flexibility did not change significantly. Gordon himself taught a basic synectic course in problem solving in the Harvard Freshman Seminar and reported that :

1. All 25 freshmen who participated in the programme thought the synectics programme as powerful and successful in attaining the objectives it set out to do.
2. They could apply the metaphor approach to both technical as well as pure problems, and could speculate spontaneously about the world around them.
3. They reported that they could improve their ability to understand and communicate complex concepts.
4. They could solve the problems.

Synectics is not merely a technique for solving difficult problems, it is also understood as a powerful technique for training people to become more flexible and original and to tolerate more ambiguity and

irrelevance. It also tends to make the mind supple, capable of rapid and breath-taking shifts to focus, a capability that may considerably increase originality.



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